

# Popular Science

FOUNDED MONTHLY 1872

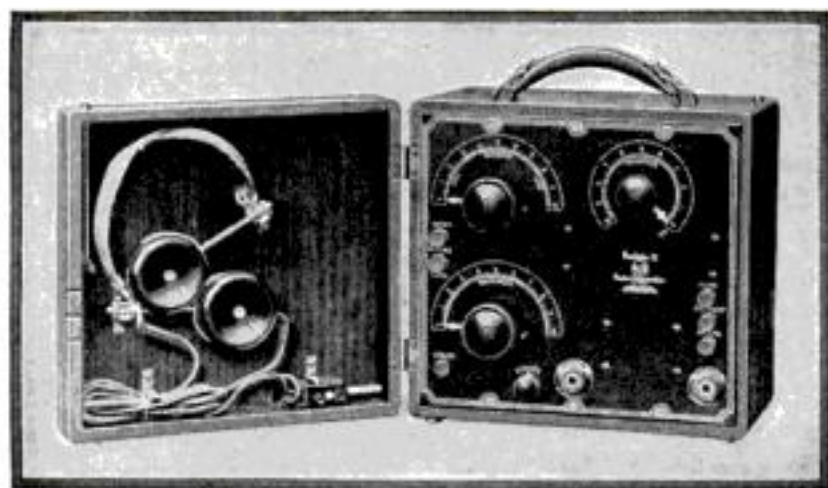


See Page 32





# Third Down — Two Yards to Gain!



**Radiola II.**

One of the most popular of Radiolas, because it's portable. At home, its fine mahogany finish makes it mighty attractive. With all its batteries inside, its handle, and its convenient size, it can be carried everywhere, on trips and visits. With even an improvised antenna, it will pick up good big distances—clearly. And over short distances, it will operate on a loudspeaker.

Complete \$97.50

Send for the free booklet  
that describes every Radiola.

RADIO CORPORATION OF AMERICA  
Dept. 2080 (Address office nearest you.)  
Please send me your free Radio Booklet.



This Symbol  
of quality  
is your  
protection

Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_

R.F.D. \_\_\_\_\_

State \_\_\_\_\_

## Get the Returns with a Radiola

Wild shouts from the crowd—"Hold that line! Hold that line!" Every play—every cheer from the rooting section. Clear and loud and *real*. With a Radiola.

It must be a Radiola. Look for the mark. When the "bunch" comes round to get the scores—you know your set will work. When the club holds open meeting, and the club room's filled—you can count upon it—always. When the big news is coming over—or an opera—a Broadway play—important stock reports—the set with the Radiola name and the RCA mark is always at the peak of performance.

Whether it's a one-tube Radiola, or the stately Radiola Grand, the name with the backing of the greatest research laboratories in the world stands for quality in every point of make, finish and performance.

*"There's a Radiola for every purse"*

at the nearest Radio or Electrical Store

## Radio Corporation of America

Sales Department  
233 Broadway  
New York

District Sales Offices  
10 So. LaSalle Street  
Chicago, Ill.

433 California Street  
San Francisco, Cal.

# Radiola

REG. U. S. PAT. OFF.



# 21 Jewel Burlington

Adjusted to the Second  
Adjusted to Temperature  
Adjusted to Isochronism  
Adjusted to Positions  
21 Ruby and Sapphire Jewels  
25 Year Gold Strata Case  
Your choice of Dials  
(Including Montgomery R. R. Dial)  
New Ideas in Thin Cases

## Only \$1<sup>00</sup> Down

Only One Dollar Down, will buy this masterpiece of watch manufacture. The balance you are allowed to pay in small, easy monthly payments. A 21-Jewel Watch — is sold to you at a price much lower than that of other high-grade watches. Besides, you have the selection of the finest thin model designs and latest styles in watch cases. Write for FREE Watch Book and our SPECIAL OFFER today.

### *The Burlington "Petite"*

This exquisite little 17-jewel ladies' wrist watch. A perfect timepiece. Beautiful, 14K Solid Green Gold case. Illustration is exact size of Burlington "Petite". Send for this wonderful little bracelet watch. See how beautiful the dainty green gold case looks on your wrist.

# Write

### *While this Special Offer Lasts*

Get the Burlington Watch Book — write today. Find out about this great special offer which is being made for only limited time. You will know a great deal more about watch buying when you read this book. You will be able to "steer clear" of the over-priced watches which are no better. Write for Watch Book and our special offer TODAY!

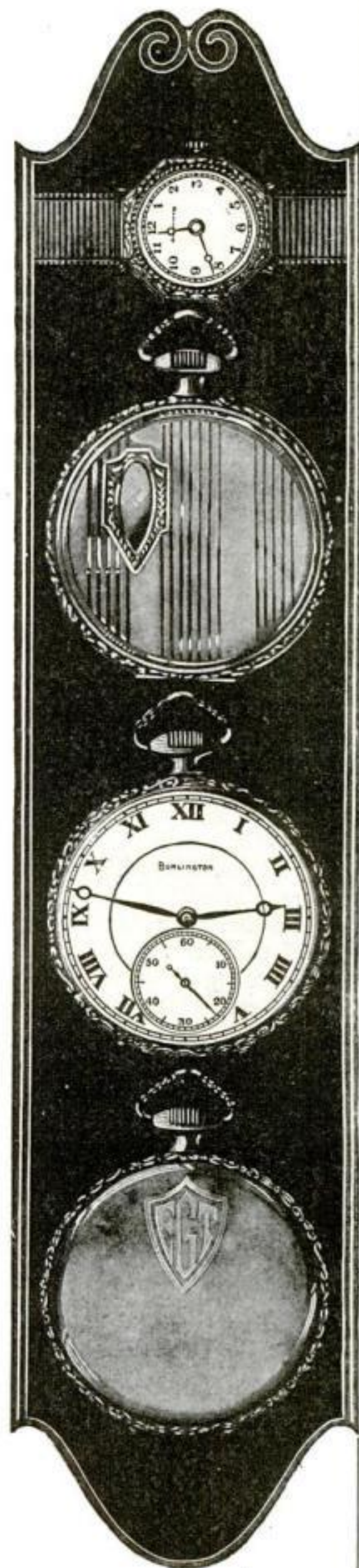
#### **Burlington Watch Company**

19th St. & Marshall Blvd., Dept. 13-68 Chicago  
Canadian Address 62 Albert St., Winnipeg, Manitoba

Please send me (without obligations and prepaid) your free book on watches with full explanation of your \$1.00 down offer on the Burlington Watch.

Name \_\_\_\_\_

Address \_\_\_\_\_





# POPULAR SCIENCE MONTHLY

Most Wonderfully Illustrated Magazine in the World

NOVEMBER, 1923; Vol. 103, No. 5  
25 cents a Copy; \$2.50 a Year



Published in New York City at  
225 West Thirty-ninth Street

**W**ITH the beginning of the twentieth century dawned the Age of Science for the average man. Before that time he looked upon Science as something far removed from his sphere of life—a dry, uninteresting, probably useless study, suited only to the bookworm and the pedant. Little by little, though, in the last two decades, he has been realizing the true meaning of Science. He has seen that Science holds an intimate, personal connection with him and the affairs of his workaday world. He has learned that Science is eminently useful, entirely practical; that it serves his comfort, relieves his distress, and increases his happiness.

\* \* \*

**U**TILITY, practical application, the satisfying of some existing human need—these ever have been the aims of Science since earliest times, the driving power behind each new scientific achievement. How human necessity furnished the goal of Science even 2000 years ago is told by J. Arthur Thomson—distinguished British author of "The Outline of Science"—in an extraordinary and informative interview on page 29 of this issue.

Beginning with Aristotle, probably the first of the scientists of whom we have exact knowledge, Professor Thomson traces the advance of Science to our own times, and makes up a list of those whom he believes to be the 10 greatest scientists of history. Even those who may not agree with Professor Thomson in his selections are bound to be struck by a remarkable similarity in the lives of all the great men of whom he tells—all of them labored unselfishly and long that their accomplishments in Science might make the world a better, happier place.

\* \* \*

**C**OMING from the days of Aristotle and Galileo to the present day, the wonders of Science still find their exemplification in fields of practical usefulness. On page 34 Raymond J. Brown tells how engineers employed by Henry Ford have devised a way to extract from the waste products of coal that now are dissipated in the air as smoke, enough motor fuel to run every automobile in the United States. Illuminating gas, motor

lubricants, valuable chemical products are other things which Ford engineers have found may be taken from coal without disturbing its industrial utility.

\* \* \*

**N**OT only for economic purposes, but in the protection of our lives and property, has the practical application of Science lately been found of value, according to Richard E. Enright, Police Commissioner of New York City, in a thrilling article on the scientific detection of crime, beginning on page 42. Describing how Science helped solve recent sensational crimes, Commissioner Enright declares that the modern police officer is surpassing the imagined feats of Sherlock Holmes every day. He predicts that through Science crime will some day be made to disappear from the earth.

\* \* \*

**T**HE Science of Medicine is of its very nature practical, but even this is steadily progressing into wider spheres of usefulness. No more remarkable example of recent practical development in medicine is furnished than the refinement of the once dangerous operation of blood transfusion to a point where it may be performed without danger in the treatment of no less than 28 specific illnesses. The story of this achievement is told on page 46.

\* \* \*

**I**N THE forefront among Americans who have seen fit to apply modern Science closely to their own lives stands Samuel M. Vauclain, president of the Baldwin Locomotive Works, who has been sick only once in his 67 years. On page 38, Mr. Vauclain tells how to insure perfect health. He has signed a 10-year contract with a physician to keep him well; and he offers a modification of his plan that may be followed by any individual, family, or community.

\* \* \*

**O**F THE many other fascinating articles in this issue—about 200 in all—each deals with a distinct field of scientific progress; yet all are alike in revealing vividly how science enters into our everyday lives—in our homes, shops, and offices—to bring us comfort, security, and happiness.

## POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3.

Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A.

Copyright, 1923, by the Modern Publishing Co.

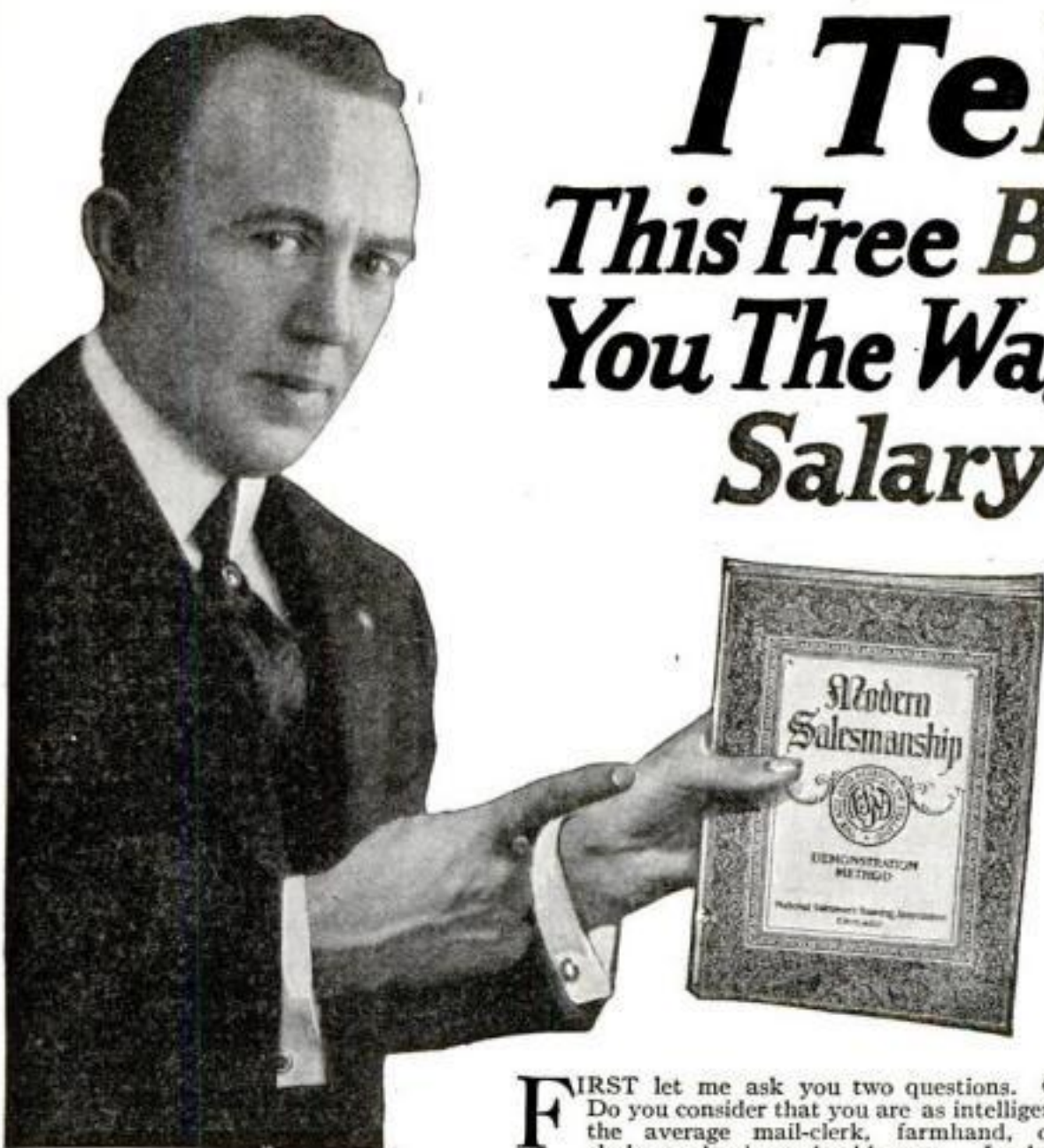
The contents of this magazine must not be reprinted without permission.

H. J. Fisher, President; R. C. Wilson, Vice-President  
O. B. Capen, Secretary and Treasurer



# I Tell You

## This Free Book Will Show You The Way to Amazing Salary Increases



*I only ask that you risk two cents on the strength of my word that the contents of this amazing book will show you the way to a prosperity that you never dreamed possible, in a fascinating field that you never thought of entering. This book is now free. Read my offer.*

**By J. E. GREENSLADE**

### Read What They Say

#### \$9,000 First Year

Ellis Summer Cook, 20 E. Jackson Blvd., Chicago, left a \$25 a week job and last year made \$9,000!

#### \$100 a month to \$100 a week in only 3 months

H. D. Miller, another Chicago boy, was making \$100 a month as a stenographer in July, 1922. In September, 3 months later, he was making \$100 a week as a salesman.

#### \$150 to \$500 a month

W. P. Clenny of Kansas City, Mo., stepped from a \$150 a month clerkship into a selling job at \$500 a month. He is making \$850 a month now.

#### \$6,500 a Year

M. V. Stephens of Albany, Ky., was making \$25 a week. He took up this training and now makes 5 times that much.

#### Small Pay to Big Earnings

J. H. Cash of Atlanta, Ga., exchanged his \$75 a month job for one which pays him \$500 a month.

#### Now Sales Manager at \$10,000 a Year

O. H. Malfroot of Boston, Mass., stepped into a \$10,000 position as a SALES MANAGER—so thorough is this training.

All these successes are due to this easy, fascinating and rapid way to master certain invincible secrets of selling.

**F**IRST let me ask you two questions. One: Do you consider that you are as intelligent as the average mail-clerk, farmhand, office clerk, mechanic, or bookkeeper. I ask you this because most of the men whose salaries have jumped are just ordinary, every-day sort of men.

Second: If you suddenly found yourself with all the money you needed to spend, wearing the best clothes, living in the finest neighborhood, driving a good car and belonging to the best clubs—but having to make good in a job that paid \$10,000 a year, would it scare you? There are men to whom \$10,000 a year is so much that the idea of earning it themselves never occurs to them. They will always be in routine jobs at low pay. Their dreams will never come true. But yours will if you will absorb what I am going to tell you. For my work in life is to take ordinary men from blind-alley jobs and show them how they can quickly make more money than they ever dreamed possible. And if you will give me a chance I'm going to show you how it's done!

Now, in one quick step you can enter the field where opportunities in your favor are ten to one—the Selling field. You know that Salesmen top the list of money-makers—that the salesman is his own boss—that his work is fascinating, interesting and highly profitable? But the thing you doubt is your own ability. All right, but **you can** become a first-class, money-making salesman in an amazingly easy way.

### Proof That Salesmen Are Made—Not "Born"

You might laugh if I told you that in a few weeks or months you could be making good in a big way in the Selling field. Thousands before you have laughed—perhaps bitterly—at the idea, but many of these thousands are now making big money as salesmen.

The story of six men who once thought salesmen were "born," who did not believe they were "cut out for selling," is on this page.

Thousands of men like these six—men who formerly thought salesmen were "born," are now enjoying magnificent earnings in the selling field. They were bookkeepers, mechanics, farmers, clerks—even doctors, lawyers and ministers—but in a few months after writing to the National Salesmen's Training Association they were out in the field selling—and making more money than they had ever hoped to make in their former vocations.

Sounds remarkable, doesn't it? Yet there is nothing remarkable about it. Salesmanship is governed by rules and laws. There is a certain way of saying and doing things, a certain way of approaching

a prospect to get his undivided attention, certain ways to overcome objections, batter down prejudice, overcome competition and make the prospect act.

Just as you learned the alphabet, so you can learn salesmanship. And through the NATIONAL DEMONSTRATION METHOD—an exclusive feature of the N. S. T. A. System of Salesmanship Training—you gain actual experience while studying.

The NATIONAL DEMONSTRATION METHOD gives you experience and knowledge that enable you to overcome sales obstacles of all descriptions easily. It is one of the many reasons why N. S. T. A. members make good as salesmen right from the start.

### A Lifetime of Selling Experience in a Few Weeks—Then Success

No matter what you are doing now, I can prove to you that you can gain years of selling experience in a few weeks—that you can go out and successfully sell goods—that you can make more money than you ever dreamed possible.

The N. S. T. A. System of Salesmanship Training and Employment Service will enable you to quickly step into the ranks of successful salesmen—will give you a big advantage over those who lack this training. It will enable you to jump from small pay to a real man's income.

### Remarkable Book, "Modern Salesmanship," Sent FREE

With my compliments I want to send you a most remarkable book, "Modern Salesmanship."

It will show you how you can easily become a master Salesman—a big money-maker—how the N. S. T. A. System of Salesmanship Training will give you years of selling experience in a few weeks; how our FREE employment service will help select and secure a good selling position when you are qualified and ready. And it will give you success stories of former routine workers who are now earning amazing salaries as salesmen. Mail the coupon to-day. It may be the turning point in your life.

**National Salesmen's Training Association**  
Dept. 15-S Chicago, Ill.

National Salesmen's Training Association,  
Dept. 15-S, Chicago, Ill.

I simply want to see the facts. Send me free your book, "Modern Salesmanship," and Proof that I can become a Master Salesman. Also tell me how you can help me to a position.

Name.....

Address.....

City..... State.....

Age..... Occupation.....



# Look Here!

Are you ambitious—are you looking for the way to Success? • Do you want an easy, pleasant job? Do you want to make from \$60 to \$100 a week? • Do you want to enjoy the luxuries of life? **Then Read My Offer!**

*My Guarantee*

to train you right at home  
—to make you an EXPERT  
DRAFTSMAN quick! I guarantee to  
prepare you to hold down any big pay job in  
any Drafting Office and to refund every cent of  
your money if you are not satisfied with my training. I  
guarantee to give you my practical JOB-METHOD instructions until  
you are actually placed in a drafting position paying **at least**

**\$250 to \$300 a month!**

I have recommended Drafting as a life-work to thousands of men during the past 20 years—I have seen them step into big-salaried positions immediately after completing my course—I have thousands of letters to prove that my "Job-Method" instruction has made these men SUCCESSFUL DRAFTSMEN—and I offer you now the same

opportunity to get into a business where there are always more jobs than Experts to fill them, where salaries are big, hours short, work is pleasant.



#### COYNE SCHOOL of DRAFTING

Immediately after completing the Coyne drafting course I went to work for Armour and Company. I held my own easily with more than a hundred draftsmen and was surprised to find graduates of other schools with a year or more of experience get stuck on problems that seemed perfectly simple to me.

Five months later I left Chicago to accept a position in New York at a large increase in salary. I owe my success entirely to the thorough Coyne training.

Very sincerely yours,  
L. T. DUBENDORF.

**BE AN EXPERT DRAFTSMAN!**

**Learn at Home in your spare time!**

Common schooling all you need. Learn in a few months. Plenty jobs everywhere—railroads, factories, builders, Cities, Counties, States, the U. S. Government, shipyards, automotive plants, architects and dozens of other lines all need Expert Draftsmen. Salaries range from \$60 to \$150 a week. Draftsmen are always in line for promotion as superintendents, managers and other official positions.

Before any machine, building or product can be made, a Draftsman must draw the plans! He's the key-man of Industry. Executives depend on him. Not a wheel can turn without him.

**Chief Draftsman,  
Coyne School of Drafting,  
1-9 S. Ashland Avenue,  
Dept. 701,  
Chicago, Ill.**

Without obligating me in any way, please send me your two books, "Drafting, the Foundation of Industry" and "Learn Drafting by the 'Job-Method'" —all absolutely free. Also complete information of your rapid home-study Drafting course, free instruments and other features.

Name.....

St. No.....

City..... State.....

**\$19 Professional Drafting Outfit FREE!**

The Coyne "Job-Method" teaches you Drafting with the same instruments and outfits you will use as an EXPERT when employed at a big salary. In order to help you START RIGHT NOW, we offer this \$19 Outfit FREE to every Coyne student. Coupon brings complete information. Mail it immediately.

**2 Books FREE!**

"Drafting the Foundation of Industry" and "Learn Drafting by the 'Job-Method'." Prices reduced, easy terms now. Mail coupon today and take advantage of this opportunity.

**Address Chief Draftsman,  
COYNE SCHOOL of DRAFTING**

**COYNE**  
SCHOOL OF DRAFTING

**1-9 S. Ashland Avenue, Dept. 701, CHICAGO, Ill.**

**MAIL COUPON TO-DAY!**





# ELECTRICITY



## Let Me Show You How to Make It Bring You \$9000 a Year

You men who are slaving away in small-pay jobs, hoping and striving for better things, I wish you could be with me here for just a few moments. I would show you how thousands of men just like yourself have quickly stepped into high-salaried positions and brilliant success in the fascinating field of electricity. In each and every case their first step toward this cherished goal was to

write to me for the same free proof I want to send to you. They followed my advice and today are leading happy, prosperous lives—many drive their own cars, own their own homes and have plenty of money to spend for the other good things in life! They are Electrical Experts—"Cooke Trained"—earning \$3500 to \$10,000 a year!

### Be an Electrical Expert—Learn at Home

Get into this great field of Electricity! Know this magic force, the ways and means it is harnessed for use in industry, and a thousand jobs will be opened to you at salaries far beyond your fondest dreams. Read Pence's story at the right! Let it be your guide post to success! Hundreds of other Cooke-Trained men have done as well, and many better! And how? Simply by taking this specialized training that quickly fits any man, no matter what his age or previous education, to take his place with the big-pay men of the country. You needn't give up your present job or go away to school, by this amazing method you may learn right at home in your spare time.

### \$3500 to \$10,000 a Year

Twenty years of actual experience all over the world in the electrical field gave me a grasp of just what a man must learn to fill an important position. My experience taught me that a man must know first the principles involved and then the best methods to apply and regulate those principles. Why make a man wade thru a lot of useless study, wasting months of precious time? And so, at enormous expense and years of effort, I evolved a system of training that is stripped of every useless step. I will make the student a practical worker! I will place in his head and hands the means to make big money as a skilled Electrical Expert! I will fit him in a short time to earn a princely salary, \$3,500 to \$10,000 a year for his skill!

### Thousands of Happy Men Say "There Is No Other Training Like This"

"You have given me a most wonderful training, a training no other school can, I feel sure, approach, much less duplicate," says F. E. Radcliffe, one of my boys who is making good in Ohio. I wish you could see the thousands of letters I get like this! John Burke of Baltimore made \$750 in spare time before he finished his training! Think what this means to you! No frittering away time serving a costly apprenticeship! Every step in this fascinating training adds earning power. You quickly become a practical man, ready to fill a big-pay job.

Many of my boys set up in the Electrical Contracting business, wiring houses, repairing motors, generators, electrical appliances, installing farm lighting systems, etc. Others set up shops and spaces in garages for repairing electrical systems on automobiles, trucks, motorcycles, etc. They are fitted at once to start in business for themselves, with practically no investment. And with the big plants, even the ordinary electrician makes good money. But the Trained Expert is the man who is Boss—he is the

big-pay man. With this training behind you, you can claim such an enviable place for yourself.

### You Cannot Lose—I Guarantee Your Complete Satisfaction

You don't have to take my word for one thing. So sure am I that after taking this training you can step right into a high-salaried position, and you will thrill with the newly found power that is yours, that I guarantee under bond to return every cent of tuition you pay me, if you are not absolutely satisfied that it is the best investment you ever made. Electricity needs you—it offers you boundless opportunity for a brilliant career. I have tried to remove every stumbling block toward accomplishing your ambition. I will help you win, if you will let me.

### Free—If You Act Now—Free Big Electrical Outfit

I know that it is only by practice with actual instruments and materials that a man can become a practical electrical expert. For that reason I give you without charge or stipulation a Complete Outfit of Electrical Tools, Materials, and Measuring Instruments. I also furnish you with supplies, examination paper, and many other things that other schools don't furnish. You actually start early in the course to work at your profession, rapidly becoming proficient, ready to do any electrical job.

### Extra—A Course in Radio Given Free for Short Time

The up-to-date Electrical Expert must know radio or wireless work, how to make and repair the various equipment. This is a mighty profitable field today, and many men are making big money in it. Because I want to make this my banner year, I am now giving this \$45.00 Course in Radio absolutely Free to new students. Don't miss this remarkable offer which might be withdrawn at any time.

Make up your mind now to get into this great profession quick. Every day lost keeps you away that much longer from prosperity and happiness! Mail the coupon today for my big free book, "How to Become an Electrical Expert." And other free proof that I can put you into the class with Pence and thousands of other Cooke-Trained men who are making princely incomes.

**L. L. COOKE,**  
Chief Engineer,  
CHICAGO ENGINEERING WORKS,  
Dept. 38, 2154 LAWRENCE AVE.,  
CHICAGO, ILL.



### \$9000 A YEAR

The picture above shows Mr. W. E. Pence of Chehalis, Washington, in his working togs. Pence is a "Cooke-Trained" man, and his letter below shows what he thinks of my course.

Dear Mr. Cooke:

Thought you would be interested in a hand-bill I have just gotten out regarding my new shop. Business is going strong, paying me now something over \$750 a month above my expenses.

And I must thank you again for my success, because it was your wonderful Course and method of instruction that put me where I am.

Your true friend,  
W. E. Pence.

### MAIL THIS COUPON

L. L. Cooke, Chief Engineer, Chicago Engineering Works, Dept. 38, 2154 Lawrence Ave., Chicago, Ill.

Send me at once "How to Become an Electrical Expert" with other proof that I can become a big-pay Electrical Expert through your training. Register me for your Special Free Offers. You send this FREE without any obligation on my part.

Name.....

Address.....

City..... State.....

**The "Cooke" Trained Man is the "Big Pay" Man**



# Money Making Opportunities for "Popular Science" Readers



## AUTOMOBILES AND ACCESSORIES

**PATENTS**—Write for free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest reference. Reasonable terms. Victor J. Evans & Company, 189 Ninth, Washington, D. C.

**AUTOMOBILE PARTS**—Used parts for most any car at half factory list prices. Allen, Briggs, Buick, Cadillac, Chalmers, Chevrolet, Dodge, Ford, Grant, Hudson, Hupmobile, Oakland, Overland, Oldsmobile, Reo, Studebaker, and many others. Send list of parts wanted. Maxwell Bros., 4106 Olive Street, St. Louis, Missouri.

**AUTOMOBILE OWNERS**, garagemen, mechanics, send for free copy America's popular motor magazine. Contains helpful, money-saving articles on repairing, overhauling, ignition, carburetors, batteries, etc. Automobile Digest, 623 Butler Bldg., Cincinnati.

## FORD ACCESSORIES

**SPEEDSTER fans**—see "Red-4-Kut" ad, page 137.

## WANTED

**TECTIVES**—Excellent opportunity. Fascinating work. Experience unnecessary. Particulars free. Write American Detective System, 1968 Broadway, New York.

**TYPISTS**—Earn \$25-\$100 weekly in spare time copying authors' manuscripts. Write R. J. Carnes, P-1, Tallapoosa, Georgia, for particulars.

**BECOME** a ship's officer on passenger and merchant ships. See the world, no enlistment. Regain your health. \$100 to \$150 per month while learning. All information necessary to start \$2. Write officer in active service. E. W. Gonyan, Detroit River Sta., Michigan, Str. L. M. Bowers.

## DUPLICATING DEVICES

**"MODERN"** Duplicators save Time, Labor and Money. Gets Business. Reproduces Typewritten or Panned Letters, Drawings, Lessons, Music, Menus, Bids, Notices, Specifications, Maps or anything in one or more colors. Prints two per minute. Special sale on. 30 days' free trial. \$2.25 up. Booklet free. J. V. Durkin-Reeves Co., Pittsburgh, Pennsylvania.

**STENCIL Duplicators**—Two Dollars. Note Size—Letter, Three-fifty. Prints Typewriting—Handwriting. On approval. Primos Specialty Co., Bx. Primos, Pennsylvania.

## LABORATORY AND CHEMICAL

**EXPERIMENTERS**. Complete supplies for the chemical laboratory. Catalogue free. National Scientific Supply Co., 241 Pennsylvania Avenue, Washington, D. C.

**YOUR** chemical problem solved and working process furnished for five dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

**LABORATORY** apparatus, reagents, scientific books for sale. For particulars address, P. O. Box 98, Ridley Park, Pennsylvania.

## TRADE SCHOOLS

**MR. ADVERTISER**: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**MAKE** Money Painting Signs and Show Cards. Book sent postpaid, \$1.10. G. W. Owens, 306 N. 40th St., Philadelphia, Pa.

## AVIATION

**THE American School of Aviation** announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 174C, 3601 Michigan Ave., Chicago, Illinois.

**PROPELLERS** for aeroplane propulsion, 5-foot diameters, \$12; 6-foot for Fords, \$15; others in proportion. Motorcycle sleigh blueprints, 75c; Ford size, \$1.00. Pictures free. Crawford Motor and Aeroplane, Long Beach, Calif.

**BOYS** get a Model Aeroplane that Dives, Spirals, Loops the Loop, like a real plane. 30 cents, coin. H. Herman, 1140 S. Sacramento, Chicago, Ill.

## MOTORCYCLES, BICYCLES, SUPPLIES

**DON'T** buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

**DEALERS** and riders: Attention: Write for our special motor cycle saving bulletins. Dealer's bulletin No. 8 and riders' bulletin No. 42. Motorcycle Parts Mfg. Co., 2030 Wabash Avenue, Chicago, Illinois.

## ROOTS AND HERBS

**GINSENG** and other Plants for Medicine, Perfume, Dyes. How to gather. Buyer's Addresses, Book 30 cents. O. Twitchell, Berlin, N. H.

## Another \$25.00 IN PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

**What advertisement of "Money Making Opportunities" in this issue interests you most-and why?**

Here are the prizes we will pay for the ten best letters answering the above question:—

First Prize ..... \$10.00  
Second Prize ..... 5.00  
Third Prize ..... 3.00  
And 7 Prizes  
of \$1.00 each ..... 7.00

First read every one of the "Money Making Opportunity" advertisements on pages 6 to 24. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, *not more than seventy words*, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before November 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the January issue. Address your prize letter to—

Contest Editor

POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York City  
Last Month's Prize Winners

The First Prize of \$10.00 goes to Frank P. O'Hare, 134 North 50th Street, Philadelphia, Pa., for his letter on the advertisement of American Chime Clock Company. Here is Mr. O'Hare's letter:—

Dear Sir:

I am interested in the advertisements, "For The Home" and "Trade Schools," because last January I built a Grandfather Clock and sold it for \$75.00. With the profit made, I took a Trade School Course which boosted my weekly earnings from \$25.00 to \$45.00 per week. Therefore, I owe the support of my wife and five kiddies to these two advertisements.

FRANK P. O'HARE.

Claude C. Kleinfeld, Winnipeg, Manitoba, Canada, wins the Second Prize for the following letter regarding the advertisement of Victor J. Evans & Company:—

Dear Sir:

I like to read an ad like the one of Victor J. Evans and Company, Patent Attorneys, Washington, because they tell you everything that is necessary in clear simple language which is not skimmed like most advertisements. It is a pleasure to read an advertisement such as this. One also notices it quickly because of its size. It stands out prominently on the page.

CLAUDE C. KLEINFELD.

The Third Prize goes to Mr. T. W. Searle, Cascade, Montana, for his letter on the advertisement of the Tourists' Pride Mfg. Company. The winners of the other seven prizes are:—

Mrs. Charles Hall, Green Bay, Wis., Brighton A. Kahn, Emporia, Kansas, J. S. Scott, Greenville, Miss., Frank G. Davis, Harrisonburg, Va., Frank Rothman, Tafton, Pike County, Pa., J. Castro Leon, Chicago Ill., Eugene Murray, Gravenhurst, Ontario, Canada.

Rate 25 Cents a Word. Advertisements intended for the January issue should be received by November 5

## RADIO AND SUPPLIES

**TESTED** radio recipes. One Skinderviken transmitter button mixed with radio set gives amplification and loud speaking. Free literature. K Electric Co., 15 Park Row New York.

**1500 MILK** vacuum tube receiver \$24.50. Radio, 4410 Market, Philadelphia.

**RADIO** generators 500 V 100 Watt \$28.50 each. Battery chargers \$12.40—High speed motors. Motor-Generators for sets, all sizes. Motor Specialties Co., Crafton, Penn.

**GENUINE** Edison Elements (new) for making "B" Batteries, obtained from U. S. Government. A positive and negative element—6c; glass tube—3c; all other parts at reasonable prices. Postage, etc., 50c extra per order. Free instructions. Todd Electric Company, 109 West 23rd Street New York.

**TUBES** Specials UV201, UV201A, WD11, WD12, C301, C301A, C299, UV199, \$5.50. Postpaid. Dealer Wanted. C. H. Anderson, Lewistown, Mont.

## MODELS AND MODEL SUPPLIES

**WE** make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

**MODEL** making and experimental work; modern shop expert workmen. Manufacturing. Lamson El. & Mfg. Co. 625 W. Jackson, Chicago.

## MOTORS, ENGINES, MACHINERY

**MOTORS**—G. E., 1/4 H.P., \$15.00; 1/2 H.P., \$32.50; 1 H.P., \$62.50. Generators, 8 volt, 10 amp., \$15.00; 32 volt, 50 watt, \$30.00. Other sizes, low prices. Motor Specialties Co., Crafton, Pennsylvania.

**SPEED** lathe—Build your own at trifling cost. Big money in wood turning. Detail blueprint No. 851, \$1.00. Jno. H. Neel, Civil Engineer, Salem, Oregon.

**POWER** Tool Grinder, Run two 6-inch wheels, \$4.80. 1/2 in. Tool Maker's Square Free. The Wentworth Co. 86, Shaftesbury, Vt.

## POULTRY AND LIVE STOCK

**POULTRY** Feeder. New principle. No waste. Sanitary. Booklet and Mash Formula Free. L. Kelly, Saranac Michigan.

## DOGS AND PETS

**AIRDALES** that I breed people appreciate. Dr. Knox, Danbury, Connecticut.

**200** Varieties, DOGS, and Pet Stock. Catalog 10 cents. Violet Hill Kennel, York, Pa.

## FORMULAS

**FORMULA** catalog free. O. A. Lutz, Apartment 24, York, Pennsylvania.

**NO** mistake Auto cleaner and polish. One operation cleans anything. Positively guaranteed. Formula, O. Dollar, Flandt & Co., Wolcottville, Indiana.

**3000** Formulas—400 pages—\$1.00 postpaid. Hume Laboratories, 14802-D-Cooper, Harvey, Ill.

## REAL ESTATE, ORCHARDS AND FARM LANDS

**ARKANSAS** land \$10.00 per acre in tracts five acres or more. Timbered land near oil development. A sound investment with good speculative chances. Write for full details. H. J. McMullen, F & M Building, Fort Worth, Texas.

**BIG** Returns from Pecan, Orange, and Fig Groves. Guaranteed care. Small monthly payments. Dept. 8. Suburban Orchards Co., Biloxi, Mississippi.

**WANTED** to hear from owner having farm or undeveloped land for sale. John J. Black, Chippewa Falls, Wis. cons.

## FOR THE HOME

**GRANDFATHER** clock works, \$5.00. Build your own case, instructions free; make good profits selling to friends. Clock works with chimes for old or new case. Write for full particulars. Clock Co., Newtown, Pennsylvania.

**GASOLINE** lamps, lanterns and heaters. Catalog free. Little Wonder Mfg. Co., Terre Haute, Ind.

## CONSULTING ENGINEERS

**STEEL** problems solved. Practical. E. W. Retter, Consulting Metallurgist, Wyomissing, Pennsylvania.

## AMERICAN MADE TOYS

**MANUFACTURERS** on large scale, also homeworkers wanted to manufacture metal toys and novelties. Mills needed of barking dogs, wag tail pup, wild animals, and models, Indiana, cowboys, baseball players, cannons, soldiers, crowing roosters, Statues of Liberty, miniature castings of capital, bathing girl souvenirs and others. Unlimited possibilities. Guaranteed casting forms furnished manufacturers at cost price from \$3.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high prices for finished goods. Cash on delivery. Contract order placed with manufacturers. Catalog and information by correspondence invited only if you mean business. Metal Cast Products Co., 1696 Boston Road, New York.

**More Money Making Opportunities  
on pages 8 to 24**



# Protect Yourself Against These Sudden Embarrassments!

A chance meeting on the street, an unexpected invitation, a cup of coffee suddenly overturned, an introduction to some person of note—these are the occasions that demand complete self-possession, that demand calmness and ease. Those who become flustered and embarrassed under circumstances like these, instantly betray the fact that they are not accustomed to good society. But those who retain a calm dignity, who know exactly what to do and say, impress others with their fine breeding—and protect themselves from humiliation.

**D**O YOU know the comfort of being always at ease—of being always sure of yourself, calm, dignified, self-possessed?

It is the most wonderful feeling in the world. You don't have to worry about making blunders. You don't have to wonder what people are thinking of you. You don't have to wish that you hadn't done a certain thing, or said a certain thing.

The next time you are at a dinner or a party, notice the people around you. See if you can't pick out at once the people who are well-bred, who are confident of themselves, who do and say the right thing and *know* it. You will always find that these people are the best "mixers," that people like to be with them, that they are popular, well-liked.

And then notice the people who are not sure of themselves. Notice that they stammer and hesitate when strangers speak to them; that they are hesitant and uncomfortable at the table, that they seem embarrassed and ill at ease. These people actually make *you* feel ill at ease. They are never popular; they always seem to be out of place; they rarely have a good time.

## Some of the Blunders People Make

At a certain theatre, recently, a man made himself conspicuous, through a blunder that could easily have been avoided. He entered a lower box with two women—probably his mother and sister. Without thinking, he seated himself on the chair that one of the women should have occupied.

The whole secret of being always at ease is to be able to do and say what is absolutely correct without stopping to think about it. One should be able to do the right thing as easily as one says "good morning."

Would you have known what seat to take in the box? Do you know who pre-



cedes when entering a theatre—the man or the woman? Do you know who precedes when leaving the theatre, when entering and leaving a street car, an automobile?

People are often confronted by sudden embarrassments at the dinner table. Often corn on the cob is refused because one does not know how it should be eaten. Some people do not know that bread must under no circumstances be bitten into. Others make the mistake of taking asparagus up in their fingers. Still others use the finger-bowl incorrectly.

How would you eat corn on the cob in public? Would you dip both hands into the finger-bowl at once, or just one at a time? What would you say to your hostess when leaving? What would you say to the young man, or woman, you had met for the first time?

## A New Knowledge That Will Give You Life-Long Satisfaction

What many people consider a "talent" for doing and saying what is correct, is really a very important social knowledge that you can acquire easily.

Would you like to know how to create conversation, how to overcome self-consciousness and timidity, how to make introductions that result in friendships, how to be an ideal host or hostess, an ideal guest?

Would you like to

know all the customs of weddings, of funerals of social calls, of formal dinners, of dances?

The famous Book of Etiquette will give you a new knowledge that you will find extremely useful. It will tell you everything you want to know. It will dispel all doubts, banish all uncertainty. It will give you ease, poise, confidence. It will make you a better mixer, a more pleasing conversationalist. It will protect you from all the little sudden embarrassments that confront the person who does not know, who is not sure.

## Free Examination Offer

Have you ever wondered why rice is thrown after the bride, why a teacup is given to the engaged girl, why black is the color of mourning?

Have you ever wondered what to serve at a tea, how to give a "shower," how to decorate the home for a wedding, a party?

Perhaps there is some particular problem that is puzzling you. Perhaps there are several. If so, why not let us send you the two volumes of the Book of Etiquette to-day—without a cent in advance? When they arrive, pay the postman only \$1.98 instead of the regular price of \$3.50. Read them and let them solve your little personal problems. Study them carefully for 5 full days and then if you do not feel that they are a splendid investment, return them and we will refund your money.

But act NOW if you want to take advantage of this special limited bargain offer. For the regular price of the Book of Etiquette is \$3.50 and we cannot maintain a reduction like this for anything but a limited period. So clip and mail the bargain coupon to-day, and the original, authentic, complete Book of Etiquette will be sent to you by return mail. The Book of Etiquette will be sent to you in a plain carton, with no identifying marks. Nelson Doubleday, Inc., Dept. 2511, Garden City, New York.

**Nelson Doubleday, Inc., Dept. 2511  
Garden City, N. Y.**

Without a cent in advance, you may send me in plain carton the complete Book of Etiquette in two volumes at the special limited bargain price. When the books arrive I will pay the postman \$1.98 (plus a few cents postage) with the understanding that I can return them in 5 days if I am not satisfied and you will refund my money.

Name.....  
(Please write plainly)

Address.....  
☐ Check this square if you want these books with the beautiful full-leather binding at \$2.98 with same return privilege.  
(Orders from outside the U. S. are payable \$2.44 cash with order. Leather binding outside U. S., \$3.44 cash with order.)

## Special Bargain!

The Famous Book of Etiquette

Nearly Half a Million Sold at \$3.50

**NOW \$1.98  
ONLY** For a Very Limited Time

For a short time only we are making this amazing offer to send you the complete, authentic, original BOOK OF ETIQUETTE at almost half the usual publisher's price!

You have always wanted to own the two remarkable books that give poise, ease, dignity, self-confidence. Almost 500,000 people have purchased them at the regular price of \$3.50. If you act NOW you can receive the same two authoritative and fascinating volumes for only \$1.98.

## SEND NO MONEY

No money is necessary. Just clip and mail the coupon to us at once. We will send you the complete, two-volume set and when it arrives you have the privilege of giving the postman only \$1.98 (plus few cents postage) for the regular \$3.50 set!

Surely you are not going to let this offer slip by. Clip and mail the coupon NOW while you are thinking about it.



# See Here!

You can make  
\$75 to \$200  
a week!

## BE AN AUTO EXPERT

Keep your Job—stay home—loan me part of your spare time and I'll make you an AUTO EXPERT quick! A liking for machinery all you need. As directing Engineer of the big CHICAGO AUTO SHOPS I train you the "JOB-WAY"—no books or useless theories in my course. I show you the short-cuts, the inside methods acquired during my 20 years in training men.

Learn to  
do any  
Job!



The Cooke-trained Auto Expert gets the big money because no job is too difficult for him. The JOB-WAY of instruction has shown him how to find the trouble instantly, and repair it quickly!

### I GUARANTEE

to prepare you to go into business for yourself where you can become INDEPENDENT. I guarantee to train you until you can hold down any EXPERT'S job at TOP SALARY. I guarantee to make you an EXPERT right in your own home—to give you the most practical instruction ever devised in every branch of Automotive Mechanics. Automotive Electricity, Battery, Ignition, Welding, Vulcanizing, etc. And I guarantee to refund your money if you are not entirely satisfied.

A Business of Your own paying \$5,000 to \$15,000 a year!

Garage  
Repair Shop  
Battery Shop  
Welding Shop

Tire Repair Shop  
Auto Electrical Shop  
Auto Accessories Store  
Tire and Battery Sales

### EXPERT JOBS \$3,000 to \$6,000 A YEAR!

Master Auto Mechanic  
Expert Auto Electrician  
Automotive Engineer  
Ignition Expert

Garage Manager  
Service Station Superintendent  
Master Salesman of Autos  
Battery or Tire Expert

**START NOW!** Mail coupon today—get all the facts quick! My big free book tells you how you can get ready to cash in on the thousands of opportunities in the world's biggest business! Let me tell you how easy I have made it for you to become a real AUTO EXPERT—in your home, in your spare time.

**CHICAGO AUTO SHOPS**

**B. W. COOKE,**  
DIRECTING ENGINEER

Dept. 206,  
1553 Madison St., Chicago, Ill.

Coupon brings FREE  
Catalog—mail it at once!

Directing Engineer Cooke,  
CHICAGO AUTO SHOPS, Dept. 206,  
1553 W. Madison St., Chicago

Please send me Free Book and complete information about your Home Study Course. I am mailing this promptly to secure Repair Outfit and the reduced prices and special terms you offer now. Of course, I am not obligating myself in any way.

Name.....

St. No. or R. F. D.....

City.....

MAIL COUPON TO-DAY!

### Directing Engineer Cooke NOW TRAINS YOU AT HOME!

Get your share of the millions of dollars spent yearly for repairs on autos, trucks, tractors. Think of it! Now 15 million cars, trucks and tractors to keep going—15 million batteries to service—50 million tires to repair and replace—15 million electrical systems to maintain! Man alive!—where else can you find equal opportunities to make real money?

### FREE!

\$18.50  
Repair Outfit

Big 21 piece Outfit given free—mail coupon and get my special offer! Hundreds of my students have paid for their course with this complete practical set of tools. You can, too! And you learn with these tools, not from books!

"Cooke trains you with TOOLS!"



## STUDY AT HOME

Directed by  
**The University of Chicago**  
Courses in English, History, Chemistry, Business, Mathematics, Education, Psychology, and 35 other subjects command credit toward a Bachelor degree. Begin any time. Address 25 Ellis Hall, University of Chicago, Chicago, Ill.

A FILE

NOT A FILE

**Stop Forgetting**

Make Your Mind an Index from which you select facts, figures, names, faces. Develop concentration, self-control, overcome bashfulness, forgetfulness. Write today for FREE memory and concentration test and illustrated booklet, "How to Remember."

**PROF. HENRY DICKSON**  
Dept. 929 Evanston, Ill.

## WANTED

### Railway Postal Clerks

\$1600 to \$2300 Year

MEN—BOYS 18 or Over  
Mail Coupon Immediately.

Steady work. No layoffs. Paid vacations.  
Common education sufficient.  
Travel—See the country.

Send coupon today—SURE



FRANKLIN INSTITUTE, Dept. B280, Rochester, N. Y.  
Sirs: Send me without charge, (1) Specimen Railway Postal Clerk Examination questions, (2) List of U. S. Government jobs obtainable, (3) Send free illustrated book, "How to Get Government Jobs."

Name.....

Address.....

## Money Making Opportunities

### ADVERTISING

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

ADVERTISING rates for magazines and weeklies free. Charles A. Lutz, Apartment 241, York, Pennsylvania.

25 WORDS—355 rural weeklies, \$14.20. Meyer Agency, 4112P Hartford, St. Louis.

INCH Display, 100 magazines, thrice \$8. Beck, 5406 Alaska, St. Louis.

### ADDING MACHINES

FREE trial, marvelous free adding machine. Adds, subtracts, multiplies, divides, automatically. Work equals \$350.00 machine. Price only \$15.00. Steady, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. O, Grand Rapids, Michigan.

### TYPEWRITERS

ALL makes, rebuilt, refinished and guaranteed ten years. \$15.00 up shipped privilege 30 days' time. Get our prices and agents proposition. Typewriter Manufacturers Exchange, Fordham, New York.

### LETTER SPECIALISTS

MY master sales letters, prepared to your order, will show big, profitable sales returns. Ad-Expert Mac Fee, 2731 Warren Avenue, Chicago.

### OPTICAL GOODS

ARTIFICIAL eyes, \$3. Booklet free. Denver Optic, 508 Barclay, Denver, Colorado.

### MISCELLANEOUS

ALL wool knitting yarns for sale from manufacturer, 95c and up per lb. Golf and plain socks. Free samples. H. A. Bartlett, Harmony, Maine.

NEW \$20 Drawing outfit—Big Bargain, \$6. Write National Instrument Co., 4704 North Hamilton, Chicago.

JOIN the old reliable card club. Membership 10c. Riverside Club, Dept. 5, Frederick, Maryland.

HOMEOPATHIC and Biochemic preparations sent postpaid to all parts of the world. Manual and booklets free. Halsey Bros. Co., 111 N. Wabash Ave., Chicago, Illinois. Established 1855.

BRITISH girls desire American correspondents. Proposition 10c. Clack, 16 Cambridge St., London, S. W., England.

CREATE international friends ups. Free information. Write: "Universalist," 1034-A West Eighteenth Street, Chicago, Illinois.

LONELY? We can help you obtain real honest sincere desirable friends. Stamp. O. B. Circle, Box 771, Reno, Nevada.

OLD reliable, most successful matrimonial club in the west. P. O. Box 21, Tacoma, Washington.

MAKE interesting new friends through jolly letters. Betty Lee, Inc., 4254 Broadway, New York City. Stamp appreciated.

LONESOME—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 43, Kansas City, Missouri.

### FOR MEN AND WOMEN

"SEXUAL philosophy," 12c. Clear, specific, authoritative, complete, best, satisfies. Fred B. Kaessmann, Lawrence, Massachusetts.

GENUINE Indian baskets, blankets and wampum—wholesale. Catalogue. Gilham, Kelseyville, California.

MAGIC words! Secret, sure method of obtaining anything you want. Postpaid for dime. Lida Smedley, 145 Miller, Brooklyn, New York.

TOBACCO or Snuff Habit cured or no pay, \$1.00 if cured. Remedy sent on trial. Superba Co., X-5, Baltimore, Maryland.

"HAGERMATH"—Specialist in Finding Solutions to Personal Problems. Give me your name and Birth date for an example of my work. P.O. Box 16—Station Y, New York City.

DETECTIVES—Work home or travel. Experience unnecessary. Write American Detective System, 1968P Broadway, New York.

HEAVEN on earth now by "Automatic Civil Service." World's greatest discovery to utilize selfishness and civilize civilization. \$1. New World, Benton Harbor, Michigan.

### HOROSCOPES

UNUSUAL HOROSCOPE—Six pages, consisting of extensive four-page Special Horoscope, Astro-Analysis and two-page valuable guide giving daily and monthly advice covering entire year. Send 50c and birthdate. Money returned if dissatisfied. Prof. T. Bolles, Box 5, Fordham Station, New York, N. Y.

WONDERFUL Self-Revealing Chart and Personality tests, 10c. Thomson-Heywood, Dept. P. S. Chronicle Bldg., San Francisco, Calif.

BE a Success Magnet. You Can Attract Prosperity, Health, Love. Let me help you. Send Birthdate and ten cents (stamps) for wonderful astral guide. Zanya, 202-B W. 105th St., New York.

### FOR SALE

FOR sale, complete set of watchmaker's tools at a bargain. R. Jaegermann, 5815 Easton Ave., St. Louis, Missouri.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

More Money Making Opportunities  
on pages 6 to 24





# Who Else Wants a New Head of Hair?

No matter how nearly bald you are—no matter how many kinds of treatment you've tried without results—this method is *guaranteed to grow hair for YOU—or your money will be instantly refunded!* Simply mail the coupon below for free proof.

By Alois Merke, Founder of Merke Institute

## ACTUAL RESULTS

### Scores of Other Letters Tell the Same Story

#### Can't Praise too Much

"I have been bothered with dandruff for twenty years and had lost nearly all of my hair. I have used your treatment 30 days now and have a good growth of hair coming in. I cannot say too much in praise of the Merke Treatment."

C. H. B.  
Parsons, Kansas

#### Bald for Years

"Kindly allow me to praise and recommend the wonderful Merke Treatment to any one who may be looking for a hair treatment which positively shows quick results. After five weeks' treatment a new growth of hair has shown on each side of the temple, where I have been bald for years."

C. B.  
New York City

#### Does Everything Claimed

"Am glad to say I can see such great change in my hair. It is growing longer and my head is full of young hair that has made its way through since I have been using Merke Treatment. I can't say enough for it. It will do everything you claim it to do."

Mrs. G. G.  
Houston, Tex.

#### Improvement Daily

"After using the Merke Treatment as per your instructions, my scalp is now showing improvement daily, and I think in time I will have more hair than I had two years ago. I was practically bare on the top, but now it is gradually filling in from the back."

J. S. W.  
Attleboro, Mass.

#### Was Skeptical Once

"I must frankly state I was decidedly skeptical as to your claims for the Merke Treatment, but a faithful use of it for a month has removed all doubt, and three of us are obtaining unbelievable results both in looks and steady growth. It has also worked wonders with the scalp, stopping all dandruff and falling hair."

L. W. F.  
Chelsea, Mass.

#### Head Covered With Hair

"I am dropping you a few lines to let you know about your wonderful Merke Treatment. The top of my head is almost covered with new hair. I have been trying for the last five years but never could find anything that could make hair grow until I used your treatment."

T. C.  
Cleveland, Ohio.



FOLKS wonder how I can make such an amazing offer. No one ever dared to do it before—to guarantee absolutely to grow hair or the treatment costs nothing at all! Here's the answer. Read the letters printed on this page—letters from those who have tried this startling new method. These are just a few of the many that pour into my office every day—letters which show without a shadow of doubt that my home treatment—in the great majority of cases—positively **does grow hair!**

I don't say my treatment will grow hair in every case. There are some cases of baldness that nothing in the world can help. But I've secured such amazing results in so many cases that I am perfectly willing to have you try my treatment at my risk! And if after 30 days you are not more than delighted with the results—if you cannot actually see a new growth of hair—then all you need to do is tell me—and without the slightest question I'll mail you a check refunding every bit of your money! **I don't want a cent of your money unless I can actually grow hair on your head—and you are the sole judge of whether or not it grows!**

## Entirely New Method

My treatment is the result of 17 years of experience gained in treating thousands of cases of baldness. This included many long years which I spent in such famous scientific research centers as Heidelberg, Berlin, Paris, Cairo and Geneva. At the Merke Institute, Fifth Avenue, New York, many have paid as high as \$500 for the results brought. Yet now—through the Merke Home Treatment—these same results may be secured at home—just a few cents a day.

My method is entirely different from anything known or used before. There is no massaging—no singeing—no "mange cures"—no unnecessary fuss nor bother of any kind. Yet results are usually noticeable after the very first few treatments.

My treatment proves that a big percentage of baldness, even of years' standing, is caused—not by dead hair roots—but by dormant hair roots which now can be awakened and made to grow again. Already scores of men and women who suffered for years from falling hair and partial baldness have acquired a thick healthy growth of hair through this amazing method, which for the first time provides a way of penetrating to the hair roots and furnishing nourishment direct to them.

## Free Booklet Explains Treatment

If you will merely fill in and mail the coupon below I will gladly send you—without cost or obligation—an interesting 32-page booklet describing my treatment in detail.

This booklet contains much helpful information on the care of the hair—and in addition shows by actual photographs what my treatment is doing for thousands of others.

If you are bald—or if right now you are merely troubled with falling hair and dandruff—this free book will prove to be of the greatest value to you. So mail the coupon now—and it will be sent you by return mail without cost or obligation.

**ALLIED MERKE INSTITUTES, INC.,**  
Dept. 1711 512 Fifth Avenue, New York City

## MORE RESULTS

### Bald Spot Growing Smaller

"Concerning the Merke Treatment will advise that it has undoubtedly benefited my hair and scalp. The 'bald spot' seems slowly but surely growing smaller, and Merke Treatment seems to be doing the work."

H. C. G.  
Baltimore, Md.

### Hair Growing Again

"I wouldn't take \$50 for your treatment. It was far beyond my expectations. My hair was dead and had no lustre. Now it is restored to its brilliancy and has begun to grow again."

J. B. C.  
Hillsboro, Tex.

### New Hair in 20 Days

"Have been using Merke Treatment 20 days and have received good results. My hair has been falling out for four years and your Treatment has checked it. I had two bald spots on my head where there was not even any fuzz, and there is new hair growing on them now. I wouldn't take \$50 for the Merke Treatment. I think it's the best in the world."

J. M.  
Smackoner, Tex.

### Satisfied With Results

"I am satisfied with results. Lots of hair is growing where I was bald. I mean in front where one mostly loses hair first. It was just as bare as the palms of my hands. Now hair is coming again."

C. F.  
Brooklyn, N. Y.

### ALLIED MERKE INSTITUTES, Inc.

Dept. 1711, 512 Fifth Ave., New York City

Please send me, without cost or obligation on my part, a copy of the new booklet describing in detail the Merke Institute Home Treatment.

Name.....

Address.....

City..... State.....



# STEP OUT from the CROWD

## You can be a Dental Laboratory EXPERT!

**This Expert Is Making \$15 to \$20 a Day!**

Easiest, pleasantest work you ever saw! Your own boss, money and success yours from the very beginning. You can start with a "shoe-string." We prepare you in a few months to run a business of your own, to do any job. Common schooling, ability to use your fingers ALL YOU NEED!

### Rubber Plates

Learn to make partial upper or lower plates with soldered, cast or wire clasps, with palatal bars; with lingual bars. McCarrie-trained Experts learn to make full rubber plates of every type, including Vulcanite base-plates, butted gums, carved gums, etc.

### CROWNS

Here's only a small part of your practical training in Crown-work: Two-piece seamless, open-face, Richmond, cast-base porcelain, Carmichael, split-pin, carved (swaged) cusp, cast cusp, etc.

### BRIDGE WORK

Complete training in both fixed and removable bridge-work. Interchangeable teeth, gold dummy, Sanitary, porcelain dummy jobs—Roach, Gilmore, Bischoff and all forms of cast-clasp work is taught—not with books but in actual Laboratory.

### METAL BASE DENTURES

Cast bases of Aluminum, gold, Watt's metal, etc., are included in your training. Both centrifugal and air pressure casting machines are used. Free catalog contains complete lists of subjects in course. Easy to learn by McCarrie Method!

## Jobs at \$60 to \$125 a Week!

In a business where there are many times as many jobs as Experts, salaries are high, hours are easy, opportunities are everywhere. McCarrie-trained Experts always get the preference—Dentists everywhere recognize the high standing of our graduates. No books here—learn with tools and instruments. Start quick—get ready in 12 weeks for your big opportunity! Mail Coupon today!

**FREE!**  
**R.R. Fare to Chicago!**

What's the use of training for the old, overcrowded trades? If you're going to prepare for big-salaried jobs or a profitable business of your own GET INTO THE NEWEST PROFESSION—"Laboratory Dentistry." Biggest opportunity for success of the century, because there are ten times as many jobs as men to fill them, because there are a dozen cities crying for Laboratories for each EXPERT capable of operating one!

### 60,000 Dentists Need Laboratory Work!

Only a few hundred Laboratories in all the U. S.—most of them in Chicago and New York. Dentists can't afford to do their own mechanical jobs. They can buy the services of a Laboratory Expert at \$3.00 an hour and sell their own time at \$6 to \$15 an hour. Dentists will encourage you to learn mechanical work, start a "Lab" of your own, give them quicker service than sending to Chicago or New York. Dentists can't wait or keep their patients waiting.

### OPEN a LABORATORY of Your OWN!

Joe Wilk of Chicago started a couple of years ago ALONE. Today he employs 60 Experts and his Laboratory is one of the biggest in the U. S. Boos in Minneapolis is reported to employ 125 men and to clear \$40,000 to \$50,000 a year. Start with the same tools you use in this big SCHOOL-LABORATORY. Start your own Laboratory with as little as \$100 investment. No limit to profits you can make in this wonderful new profession.

### INTERESTING CATALOG—FREE!

Right this minute we can place 150 Dental Laboratory Experts in locations where they can make \$5,000 to \$20,000 a year. But you can't cash in, take advantage of these OPPORTUNITIES until you're TRAINED. Catalog tells you how quickly and easily you can get ready, how hundreds of others have SUCCEEDED!

Tells you how you learn in few months BY DOING ACTUAL LABORATORY JOBS under world's greatest Mechanical Dentists! Brings you FREE R. R. Fare offer and other big inducements. Write for free Catalog today!

**McCarrie School of Mechanical Dentistry**  
Dept. 102, 34 and 36 W. Lake St., Chicago

### EARN while you LEARN!

Day students make all or part cost of course by part-time night work. Night students can find plenty of good jobs in Chicago "to see them thru." We'll help you!

**McCarrie School of Mechanical Dentistry,**  
Dept. 102, 34 and 36 W. Lake St., Chicago

Without obligation, please send me your Free R. R. fare offer and free catalog with complete information about how I may become a Dental Laboratory EXPERT.

Name.....  
St. No. or R. F. D.....  
City..... State.....

## "STAMMERING

### Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents, coin or stamps, for 288 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.

BENJAMIN N. BOGUE, 699 Bogue Bldg., 1147 N. III St., Indianapolis



## MAKE MONEY AT HOME

15 to 50 Dollars a Week for Your Spare Time. No Canvassing. Experience Unnecessary. Write today for Illustrated Booklet and Free Working Outfit. UNITED SHOW CARD STUDIOS, 507 Blass Bldg., Detroit, Mich.

## BLUE PRINT READING STOP WASTING SPARE TIME

Make a few spare minutes pay you money. Learn how to get the biggest job you've ever had. Don't be satisfied with a small pay envelope every week. Become a trained BLUE PRINT MAN. Here's the big chance to earn more money. Don't miss it. Write today. Tell us what trade interests you—we will send free details of our plan.

Earn \$35—\$100 Every Week. Become a trained draftsman. Draw a big salary. Get out of the rut. Write today for Free Drafting Catalog.

**COLUMBIA CORRESPONDENCE SCHOOL, Est. 1904**  
Dept. 23, Drexel Bldg., Philadelphia, Pa.

## BE A TRAFFIC MAN

### DEMAND INCREASING DAILY

With the energetic revival of business activities, the demand for men trained to handle transportation problems is greater than ever before. Our highly specialized course prepares you for this high salaried profession. Personal attention and practical experience—with successful Traffic Men. Special plan to help pay your tuition. Post graduate course FREE. Write today for full information.

**INTERSTATE TRAFFIC SCHOOL**  
211 Traffic Bldg. Fort Wayne, Ind.

## Money Making Opportunities

### PRINTING, ENGRAVING, MULTIGRAPHING

**BETTER** printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars will be sent for 10 cents to pay postage. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

**EMBOSSING** business, personal stationery. Samples, stamp. Daniels P. Company, Pittston, Pennsylvania.

**225 BOND** letterheads, envelopes, billheads, cards, \$1.25 each. Combination, \$4. Economic Printery, Leonia, New Jersey.

**LETTERHEADS**, envelopes, 500, \$2.65. Samples free. Quality Printery, Marietta, Ohio.

**200 PERSONAL** correspondence letterheads, 100 envelopes, \$1.00. "Superior," 1825 Roosevelt, Indianapolis, Indiana.

**ARTISTIC** visiting cards. Embossed in gold. 100, 40c.; 300, \$1.00. Card case free. Artistic Printery, 45 Sixth Avenue, Newark, New Jersey.

**1,000 HAMMERMILL** letterheads, envelopes, \$3.25; 250, \$1.25. Samples free. Troib Press, 98-A Providence, Worcester, Mass.

**EVERYTHING** Printed. Samples free. Franklin Press, B-34, Milford, New Hampshire.

**PERSONAL** Stationery, 100 special size letterheads and 100 envelopes, printed name and address for \$2.00. Agents wanted. King Supply Co., 335 Taylor Street, Topeka, Kansas.

**PRINTING** Catalogs, Folders, Letterheads, Envelopes, etc. Our prices talk. A few samples free. Society stationery special. Your name and address printed in rich blue on 200 sheets and 100 envelopes for \$1.00 postpaid. West of Denver \$1.10. A. H. Kraus, Kraus Bldg., Milwaukee, Wis.

**500 EACH** Hammermill bond letterheads, envelopes, \$4.50. Multigraphed letters \$4.25 thousand, delivered. Anderson, 205 N. Church, Rockymount, N. C.

**1000 BOND** letterheads. Mailed \$3.50. Express and Standard Corporation, Newport City, Vt.

### MANUFACTURING

**UNUSUAL** opportunity—New factory well equipped for dies, stamping, die-casting, screw-machine and wire products. Plating, enameling, burnishing. Quotation to responsible parties. Metal-Craft Mfg. Co., Box 259, Chicago.

### EDUCATIONAL AND INSTRUCTION

**DEGREES** earned by correspondence study in Engineering, science, law, theology, medicine, etc., 700 courses. Catalog free. P. S., Oriental University, 1702 Oregon Avenue, N.W., Washington, D. C.

**DOUBLE** entry bookkeeping mastered in 60 hours; guaranteed; diploma. International Bookkeeping Institute, Springfield, Missouri, Desk 10.

**LINCOLN-JEFFERSON** University. Home Study in Academy College, Theological, Law, Music, Pharmacy, Business and Graduate schools, leading to degrees. Box G, 64 W. Randolph Street, Chicago.

**HYPNOTISM** easily learned. Lessons guaranteed. Postpaid \$1.10. Smith Publishing Co., Springfield, Mass.

**SHORTHAND** in 100 hours. Most rapid readable system. Introductory booklet free. Memoscript Institute, Roanoke, Virginia.

**USED** correspondence courses and educational books bought and sold. Attractive prices. Educational Service, Park Avenue, Piqua, Ohio.

**USED** correspondence courses bought and sold. Bargain catalogue 1000 courses free. Students' Exchange, Dept. 3, 47 West 42d Street, New York.

**FREE** Scholarship in Shorthand. Secretary, 1552 Broadway, Grand Rapids, Michigan.

**500 "FREE** Tuition Scholarships" to be granted to first applicants. Normal, high school, collegiate and business courses thoroughly taught by mail. Apply Carnegie College, Rogers, Ohio.

**BECOME** an expert stenographer and earn while you learn. Best system of Shorthand and Touch-typing taught by mail. Information free. Mattox Twome Institute, 3292 Sacramento St., San Francisco, Calif.

**BE a Detective.** Earn \$250 to \$300 per Month. Be a Finger Print Specialist. Learn Scotland Yard Methods. Experience not necessary. Write today for Free illustrated booklet. United Detective Tr. Ass'n, 8071 Dinan Bldg., Detroit, Mich.

### ARTISTS' MATERIALS

**PAINTERS**, decorators, printers, artists—3000 color mixing guide, \$1.00. Fine Arts Publisher, 1125 W. 27th, Indianapolis, Indiana.

### OFFICE DEVICES

**ADDRESSING** machines, multigraphs, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Pruitt, 170-Z North Wells, Chicago.

### MAILING LISTS

**100 NAMES** and Addresses, printed on gummed paper, 15 cents, coin preferred. Lloyd Reeve, 328 Richards, Dover, N. J.

### MAIL ORDER BUSINESS

**\$50 a week**, evenings. I made it. Mail order business, booklet for stamp tells how. Sample and plan 25c. Free, 12 articles worth \$3. Alps Scott, Cohoes, New York.

### CONSULTING ACCOUNTANTS

**ACCOUNTING**, bookkeeping, business problems solved; new books installed; by mail. Low rates. W. F. Bachensko Co., 4525 Broadway, Chicago.

### CHINESE NOVELTIES

**BUY** oriental goods at wholesale prices, save 30%. Catalog free. Shanghai Trading Co., San Francisco.

**More Money Making Opportunities on pages 6 to 24**

Copyrighted material



# Are You the Ten-pin —or the Ball?



WHEN a championship contest is impending, the athlete who trains spasmodically, or who refuses to train at all, is regarded by his team-mates with contempt. His self-indulgence is never a subject for joking—it is nothing short of treachery.

The business world views the matter somewhat differently.

If a man neglects to train for a bigger job, why worry? There are plenty of able and ambitious men who *will*.

Every year, for example, more than 60,000 men enrolled with LaSalle Extension University are throwing themselves heart and soul into the all-engrossing contest for the better positions in business—are earnestly declaring their purpose to win or know the reason why.

In the contest for success they know that they must be either the ten-pin or the ball—and they prefer to be the ball.

The career of C. C. Mollenhauer well illustrates the opportunities that unfold to the man equipped to take advantage of them.

Obligated to leave school at the age of twelve, Mollenhauer started life as a clothes-brusher in a factory, at \$2.50 a week. Today, at thirty-five, he is partner in a large real-estate firm, a director in the great First National Bank of Brooklyn, and a trustee of the Dime Savings Bank in Williamsburg, New York.

"The big event of my life," says Mollenhauer, "was the day I enrolled with the LaSalle Extension University. The Problem Method, developed by LaSalle, is surely the quickest way to the top I know of. It has meant thousands of dollars to me, to say

nothing of the innumerable other benefits I have derived from it. The only regret I have ever had is that I did not enroll sooner."

When a man held down to so unpromising a start is able—by the aid of home-study training—to outclass his competition so decisively, how certain should be the future of the man who starts to train without unusual handicap.

Thousands of LaSalle-trained men unconsciously direct attention to this thought; their letters are replete with evidence, of which such statements as the following are typical:

"At the last stockholders' meeting I was made general auditor, at a salary-increase of 200 per cent since my enrollment. Without LaSalle I should not have been considered for this responsible position."—F. H. Ranney.

"Since enrolling I have increased my income from \$90 to over \$400 a month, and the end is not in sight."—M. C. Kochman.

"LaSalle training has meant a tremendous thing to me in mental development and financial profit."—W. A. Twelkemuir.

"Passed bar examination with second highest honors in a class of 71."—M. A. Caruso.

"LaSalle training has taken me from the \$65-a-month class to a present earning power of over \$7,000 per annum."—R. A. Warner.

To overcome the obstacles that every man must face who hopes to attain executive responsibility requires earnestness of purpose; and beyond a doubt the unusual success of LaSalle-trained men is due, in considerable measure, to the inherent pluck and determination which gave them the urge to make the start.

The rapidity of their advancement, however, brings forth a different explanation—to be found, as many assert, in the LaSalle Problem Method.

Under this plan, distinctive with LaSalle Extension University, a member masters business principles by solving actual business problems—under the direction of some of the ablest men in their respective fields in America. The business power that

results from such practical and thorough preparation is a constant menace to the man who will not train.

During three months' time, for example, as many as 1,193 LaSalle members reported definite promotion—over the heads of untrained men. Incidentally, the total salary-increases of these men amounted to \$1,248,526, an average increase per man of 89 per cent.

In the face of such plain handwriting on the wall, how pathetic is the man who fails to see the necessity for specialized business training—or who casts aside his present opportunity, to await a day that never comes.

On the other hand, how great the rewards that accrue to the man who recognizes his need—and acts decisively to meet it.

During coming months what will you be doing with your spare evening hours? Will you be preparing to hold your own against these thousands of men who are plussing their natural ability and stamina with training—or will you go down like a ten-pin, beaten by some man, not so good as you, perhaps, who has equipped himself to play the game successfully?

A booklet which has proved of unusual worth to many thousands is available to you; it will give you full particulars of a definite plan for self-improvement—will show you compelling evidence of what other men in circumstances similar to yours have done to increase their salaries and to step ahead to responsible executive positions. With this booklet LaSalle will send you without obligation your copy of "Ten Years' Promotion in One," a human-interest recital of how an average man won his way to success.

The arena is built—the great game for success in business is in progress—and whether you will or no you must step to the mark and do your best.

Just such a coupon as appears below this text has given many a man his start toward real achievement. Check, sign and mail that coupon NOW—and write it on your heart that you are in the fight to win.

## LASALLE EXTENSION UNIVERSITY

The Largest Business Training Institution in the World

### Outstanding Facts About LaSalle

Founded in 1908.

Financial resources more than \$7,500,000.

Total LaSalle organization exceeds 1600 people—the largest and strongest business training institution in the world.

Numbers among its students and graduates nearly 400,000 business and professional men and women, ranging in age from 20 to 70 years.

Annual enrollment, now about 60,000.

Average age of members, 30 years.

LaSalle texts used in more than 400 resident schools, colleges and universities.

LaSalle-trained men occupying important positions with every large corporation, railroad and business institution in the United States.

LaSalle Placement Bureau serves student and employer without charge. Scores of big organizations look to LaSalle for men to fill high-grade executive positions.

Tuition refunded in accordance with terms of guarantee bond if student is not satisfied with training received upon completion of course.

### INQUIRY COUPON

LASALLE EXTENSION UNIVERSITY Dept. 1183-R CHICAGO, ILLINOIS

Please send me catalog and full information regarding the course and service I have marked with an X below. Also a copy of your booklet, "Ten Years' Promotion in One," all without obligation to me.

☐ Business Management: Training for Official, Managerial, Sales and Executive positions.

☐ Modern Salesmanship: Training for Sales and Advertising Executives, Solicitors, Sales Promotion Managers, Salesmen, Manufacturers' Agents and all those engaged in retail, wholesale or specialty selling.

☐ Higher Accountancy: Training for positions as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.

☐ Railway Station Management: Training for Railway Auditors, Comptrollers, Accountants, Clerks, Station Agents, Members of Railway and Public Utilities Commissions, etc.

☐ Industrial Management Efficiency: For Executives, Managers, Office and Shop Employees and those desiring practical training in industrial management principles and practice.

☐ Law: Training for Bar; LL.B. Degree.

☐ Traffic Management—Foreign and Domestic: Training for positions as Railroad or Industrial Traffic Manager, etc.

☐ Modern Business Correspondence and Practice: Training for Sales and Collection Correspondents; Sales Promotion Managers; Credit and Office Managers; Correspondence Supervisors, Secretaries, etc.

☐ Banking and Finance.

☐ Modern Foremanship and Production Methods: Training in the direction and handling of industrial forces—for Executives, Managers, Superintendents, Contractors, Foremen, Sub-foremen, etc.

☐ Personnel and Employment Management: Training for Employers, Employment Managers, Executives, Industrial Engineers.

☐ Commercial Law.

☐ Expert Bookkeeping.

☐ Business English.

☐ Commercial Spanish.

☐ Effective Speaking.

☐ C. P. A. Coaching for Advanced Accountants.

Name..... Present Position.....

Address.....





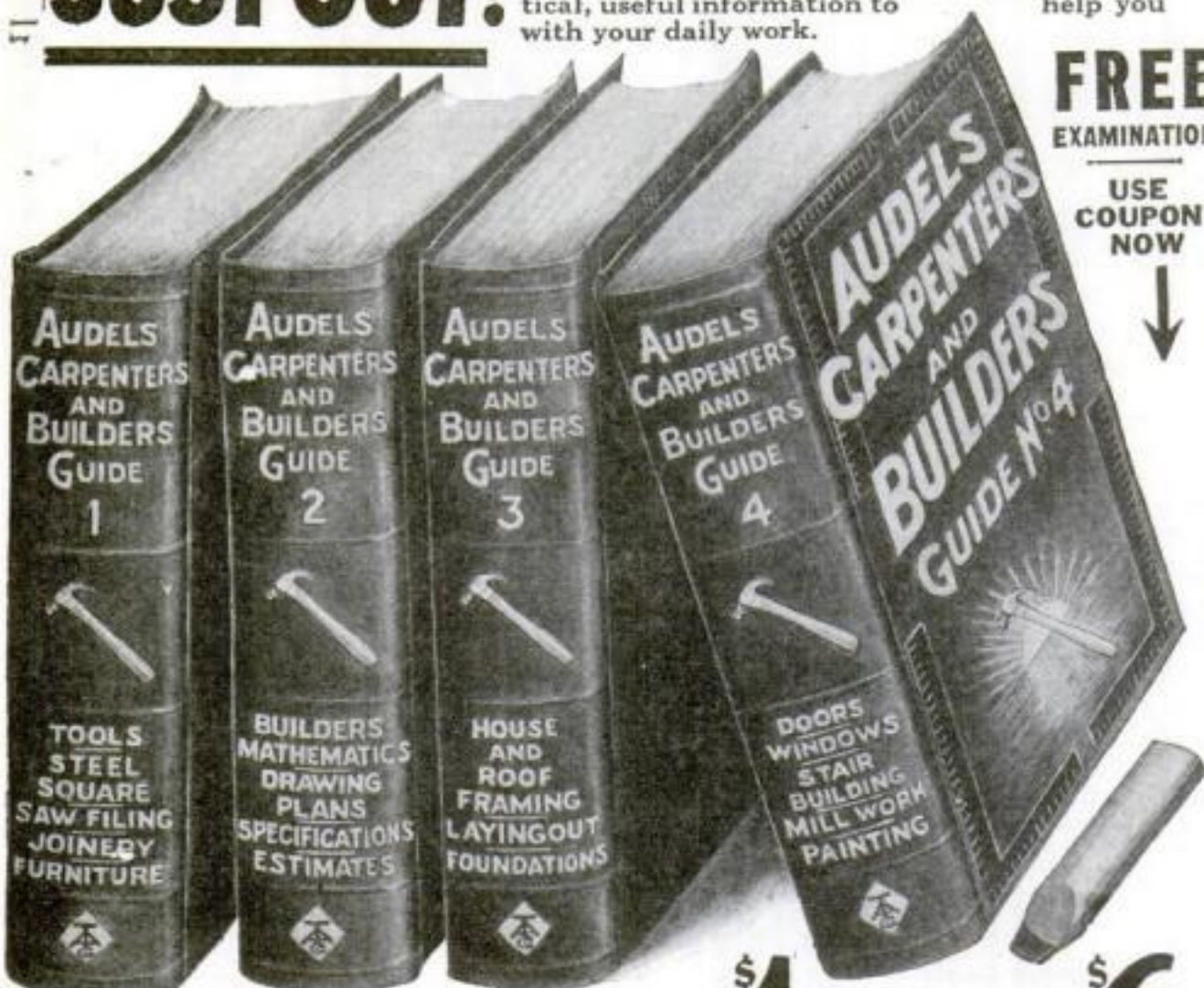
# CARPENTERS AND BUILDERS!

Just available—Audel's Carpenters and Builders Guides—the short cut, professional information you want.

A Guide that keeps you in close touch with your work and shows you how you may increase your earning power.

No need to guess or take chances. Every day you have before you in this set, exact, practical, useful information to help you with your daily work.

## JUST OUT!



### POCKET SIZE-FLEXIBLE COVERS

There are thousands of examples of modern construction and building work—new methods, new ideas, proved efficiency plans, short cuts, time saving suggestions, new ways that cover the entire theory and practice of modern carpentry. Every point is

easy to read and understand and clearly illustrated with sketches and forms. Decide for yourself whether they are worth the money to you. Pay only \$1 a month if you like them. Return the Guides if you don't. **USE COUPON NOW!**

## HOW To Handle the Job That Puzzles YOU

How to use the different kinds of wood—complete detailed information on nails and screws—how to use the steel square—how to file and set saws—how to make wood joints—how to build furniture—how to make a mitre shooting board—how to plumb, and level work—how to lay out work—how to understand

carpenter's arithmetic—how to solve mensuration problems—how to estimate the strength of timbers—how to proportion beams—how to read plans—how to draw up specifications—how to estimate the cost of buildings—how to build houses, barns, garages, bungalows, etc.—how to build foundations—how to proportion foundation footings—how to frame houses—how to set girders and sills—how to frame joists—how to frame a studding—

how to set window frames—how to cut rafters—how to use the settings 12, 13, and 17 on the steel square—how to put on wood, fibre and metal shingles—how to hang doors—how to frame windows—how to put on sheathing—how to put on exterior trim—how to do cornice work—how to build stairs—how to lay floors—how to paint.

# FREE EXAMINATION

Not a cent to pay until you see the books. No obligation to pay unless you are satisfied. Send coupon now—today and get this fine, helpful new set for Carpenters and Builders. After you have looked them over 5 days send only \$1, then \$1 a month until \$6 is paid—if you want to keep them. Return them if you do not.



**SEND NO MONEY**  
SEND THIS COUPON ONLY

THEO. AUDEL & CO., 72 Fifth Avenue, New York City.

Please submit me for approval and free examination:—

**AUDEL'S CARPENTERS AND BUILDERS GUIDES**

Ship at once, prepaid, the 4 numbers. If satisfactory I agree to send you \$1 within five days and to further mail you \$1 monthly until \$6 is paid.

Name.....

Address.....

Employed by.....Reference.....

Pop. Sci. Nov. '23

## Money Making Opportunities

### PHOTOGRAPHY AND SUPPLIES

FREE 8"x10" enlargement from your favorite negative. Write for Card "S." Liberty Photo Company, O-We-Go, New York.

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 156 Camera House, Boston, 17, Massachusetts.

SPECIAL Trial Offer. Any size Kodak film developed for 5c; prints 3c each. Over-night service. Get a Free Auto. Ask for details. Roanoke Photo Finishing Co., 212 Bell Avenue, Roanoke, Virginia.

CAMERA owners: Make your own pictures. Details free. E. E. Burket, Roaring Spring, Pennsylvania.

CAMERA Hospital: Expert camera repairing a specialty. Send your broken camera, will write you cost. Turner, 1679 Ave. A, New York.

SAMPLE enlargement, dime and negative (returned). Sample 6-exposure roll finished glossy, 25c silver. Brown Studio, Lake Elmo, Minnesota.

### GAMES AND ENTERTAINMENTS

MAGIC, stage money, books. Catalogs 10c. Gilmaglio, Morgan Park, Chicago.

TRICKS—Parlor or stage. Superior quality. 160-page illustrated catalog, 10c. Oaks Magical Co., Dept. 200, Oakkosh, Wisconsin.

YOU'LL have lots of fun exchanging cheery letters in my club. Eva Moore, Box 908, Jacksonville, Florida. (Stamp.)

EXCHANGE interesting letters with new friends. Dolly Gray Club, Box 186J, Denver, Colorado.

PLAYS, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogues, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 26, Chicago.

### AUTHORS—MANUSCRIPTS

WRITE for newspapers and magazines. Big pay. Experience unnecessary, details free. Press Reporting Syndicate, 400, St. Louis.

WRITERS—Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

FREE to writers—a wonderful little book of money-making hints, suggestions, ideas; the A B C of successful story and play-writing. Absolutely free. Just address Authors' Press, Dept. 15, Auburn, New York.

\$\$\$ FOR Ideas. Photoplay plots accepted any form, revised, criticized, copyrighted, marketed. Advice free. Universal Scenario Corporation 214 Security Bldg., Santa Monica and Western Avenue, Hollywood, California.

BIG money in writing photoplays, short stories, poems, songs, etc. Send today for free copy America's greatest magazine for writers. Filled with practical help in writing and selling. Writers' Digest, 636 Butler Building, Cincinnati, Ohio.

### BOOKS, PERIODICALS

SEND for New Illustrated Catalog of Books on Mechanical Subjects Free. Spon & Chamberlain, 1220 Liberty Street, New York.

DISEASES and their innate healer, 25c. Arthur Stevens, Wauseon, Ohio.

"LIGHTS, Colors, Tones and Nature's Finer Forces," including vibrations; odic-auras; cold-lights; radio; inventions; illustrated; 270 pages, \$2.00. Circulars free. Stevens Science Publishers, 242 Powell, San Francisco.

HYPNOTISM Astounds, controls others. Wants gratified. 25 easy lessons, \$1.10. "Mindreading" (any distance). Wonderful, \$1.10. Popular Institute, PS 1014, Belmont, Chicago.

MY New Book, "Theology and Creation vs. Evolution and Darwinism," ready for distribution Oct. 1st. Scientific; interesting to young and old; serious and humorous; good animal stories; well bound. Postpaid \$1.00. S. O. Bryant, Bethany, Missouri.

FOR Sale, Set Harvard Classics. First Class Condition. Geo. Tuttle, Postville, Iowa.

### MOTION PICTURE BUSINESS

WRITE photoplays; \$50 each. Experience unnecessary. Details free to beginners. Producers' League, 312, St. Louis.

AMERICA'S Greatest Fortunes made in this Business. Complete outfits sold on Easy Payments. No experience needed. Opportunities everywhere. Free Catalog. Monarch Theatre Supply Co., Dept. 19, Memphis, Tenn.

BARGAINS in used film and projectors. New miniature projectors, \$4.50 to \$30.00. New professional projectors, \$185.00 to \$400.00. Movie Sales, High Ridge, Mo.

### MUSIC AND SHEET MUSIC

POEMS wanted—Sell your song verses for cash. Submit MSS. at once or write New Era Music Company, 117, St. Louis, Missouri.

COMPLETE, easy self-instructors—Harmonica, Violin, Piano, Drum, Ocarina, Ukulele, Accordeon, Saxophone—25c each. Elsen, Publisher, Bowling Green, Ohio.

PROMINENT London music publisher is open for available songs by American writers—amateur or professional; songs judged on merit—not writers' reputations. For further particulars write to American representative, Jack Mahoney, Dept. 8, 145 West 45th Street, New York.

PIANO JAZZ, note or ear. Short mail course. Beginners or advanced. Learn 92 Bass Styles, Novelty Solos, 215 Syncopated Fillers, Endings, Blues. Waterman School, 260 Tait Bldg., Los Angeles.

### CHALK TALKS

LAUGH producing program, \$1.00. Circulars free. Cartoonist Balda, Oshkosh, Wisconsin.

100 LIGHTNING Chalk Talk Stunts. \$1.00. Cartoonist, 2925 Euclid, Kansas City.

**More Money Making Opportunities**  
on pages 6 to 24

Copyrighted material





# The \$12 a week mechanic who became a millionaire!

**T**WENTY-THREE years ago, John C. Wahl was working as a mechanic in Peoria, Illinois, at \$12 a week.

To-day, he is a millionaire—having an income that runs into six figures—nationally and internationally known as the inventor of the Wahl Adding Machine, the Wahl Fountain Pen, and president of The Wahl Company, manufacturers of the famous Ever-sharp pencil.

It is interesting to note that the change for the better in the life of John C. Wahl came the day he saw an advertisement that hit him straight between the eyes. As he puts it, "it told how the International Correspondence Schools could make a draftsman of a fellow without interfering with his daily work." That day, John C. Wahl enrolled and started to build for the future. His present success is proof that he builded well.

"Pick the line of work you like best," he said the other day, "and stick to it. Study hard and success will take care of itself. Nothing is impossible when a man makes up his mind that he's going to get ahead."

John C. Wahl is just one of thousands of I. C. S. students who, by study and close application to business, have made good in a big way. The lives of such men should be an inspiration and a guide to every man who wants a better job and a bigger salary.

If the I. C. S. can smooth the way to success for other men, it can help you. If it can

help other men to go forward to better jobs and bigger salaries, or to success in businesses of their own, it can help you, too.

At least find out *how* by marking and mailing this coupon. It doesn't obligate you in any way, but it may be the means of changing your entire life.

## MAIL THE COUPON TO-DAY!

----- TEAR OUT HERE -----  
INTERNATIONAL CORRESPONDENCE SCHOOLS  
Box 7660-C, Scranton, Penna.

Without cost or obligation, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

### BUSINESS TRAINING COURSES

- |   |   |
|---|---|
| <input type="checkbox"/> Business Management            | <input type="checkbox"/> Salesmanship                                     |
| <input type="checkbox"/> Industrial Management          | <input type="checkbox"/> Advertising                                      |
| <input type="checkbox"/> Personnel Organization         | <input type="checkbox"/> Better Letters                                   |
| <input type="checkbox"/> Traffic Management             | <input type="checkbox"/> Show Card and Sign                               |
| <input type="checkbox"/> Business Law                   | <input type="checkbox"/> Lettering  |
| <input type="checkbox"/> Banking and Banking Law        | <input type="checkbox"/> Stenography and Typing                           |
| <input type="checkbox"/> Accountancy (Inc'd'g C. P. A.) | <input type="checkbox"/> Business English                                 |
| <input type="checkbox"/> Cost Accounting                | <input type="checkbox"/> Civil Service                                    |
| <input type="checkbox"/> Bookkeeping                    | <input type="checkbox"/> Railway Mail Clerk                               |
| <input type="checkbox"/> Private Secretary              | <input type="checkbox"/> Common School Subjects                           |
| <input type="checkbox"/> Spanish                        | <input type="checkbox"/> High School Subjects                             |
| <input type="checkbox"/> French                         | <input type="checkbox"/> Illustrating <input type="checkbox"/> Cartooning |

### TECHNICAL AND INDUSTRIAL COURSES

- |  |  |
|--|--|
| <input type="checkbox"/> Electrical Engineering                          | <input type="checkbox"/> Architect                                   |
| <input type="checkbox"/> Electric Lighting                               | <input type="checkbox"/> Blue Print Reading                          |
| <input type="checkbox"/> Mechanical Engineer                             | <input type="checkbox"/> Contractor and Builder                      |
| <input type="checkbox"/> Mechanical Draftsman                            | <input type="checkbox"/> Architectural Draftsman                     |
| <input type="checkbox"/> Machine Shop Practice                           | <input type="checkbox"/> Concrete Builder                            |
| <input type="checkbox"/> Railroad Positions                              | <input type="checkbox"/> Structural Engineer                         |
| <input type="checkbox"/> Gas Engine Operating                            | <input type="checkbox"/> Plumbing and Heating                        |
| <input type="checkbox"/> Civil Engineer                                  | <input type="checkbox"/> Chemistry <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Surveying and Mapping                           | <input type="checkbox"/> Automobile Work                             |
| <input type="checkbox"/> Metallurgy <input type="checkbox"/> Mining      | <input type="checkbox"/> Navigation                                  |
| <input type="checkbox"/> Steam Engineering                               | <input type="checkbox"/> Agriculture and Poultry                     |
| <input type="checkbox"/> Radio <input type="checkbox"/> Airplane Engines | <input type="checkbox"/> Mathematics                                 |

Name.....  
Street.....  
Address.....  
City.....State.....

Occupation.....

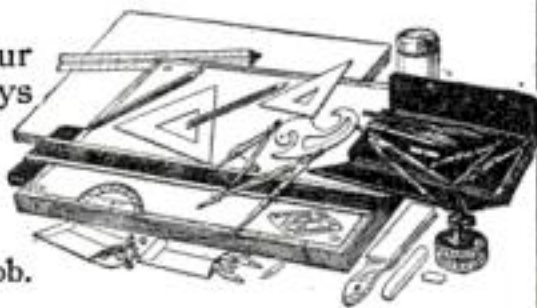
Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.





## Get Expert Training in DRAFTING Raise Your Income

Send For **FREE** Trial Lesson



Become a skilled Draftsman and your future is settled. Your services will always be in demand by great organizations willing to pay top-notch salaries to men who can undertake important work and get it done. Never before such a call for men with practical knowledge of Drafting. Don't put in your time in hoping and wishing for better things or in working in a small pay job. Learn Drafting.

### Chicago Tech. Will Train You By Mail

Right in your own home you can become a proficient practical Draftsman. The Chicago Tech. experts will train you by mail, giving you the same thorough instruction you would get if you came to the College. Hold your present job and master Drafting in your spare time. Just a few hours a week is all you need to put in. No interference with your present work—and you put yourself years ahead of men without the ambition to get the specialized knowledge which means quick advancement and more money.

Salary increased 75% by Chicago Tech. training.  
T. F. Anderson.

My income increased 92% since enrolling with Chicago Tech.  
S. Patrick.

Have had my pay raised \$73.70 a week since I took the Chicago Tech. course.  
S. Schrier.

#### To Employers:

Chicago Tech. men are practical. Write to us when you need Draftsmen.

## FREE Trial Lesson

Just sign and mail the coupon and we will send this Trial Lesson which will show you how well prepared you are to take up Drafting. While other schools ask you to enroll and pay a fee before you receive instruction, we send you this free lesson first. Before you pay—before you even decide about enrolling you test your ability and see just how we teach Drafting by mail. Send today—no money, only the coupon.

### Make Your Spare Hours Count for More Money

Chicago Tech. training gives you the experience of men who know what kind of training equips a man for quick advancement and a high salary. You get the kind of knowledge in Drafting that has the highest value measured by the pay check—and this simply by utilizing your spare time. No need to hesitate on account of cost. The fees are small and the terms easy.



## FREE Drawing Outfit

Students enrolled with Chicago Tech. for home study in Drafting receive this complete Drawing Outfit with no extra charge (or credit on fees if they have outfits). A regular full size outfit—the same as used by practical draftsmen and engineers.

## Send the Coupon

Mail the coupon and get the Free Trial Lesson—also catalogs and full information about the Chicago Tech. Method of teaching Drafting by mail. Find out about the opportunities that Drafting offers to ambitious men. No cost to you—no obligation. Send the coupon today.

**CHICAGO TECHNICAL COLLEGE,**  
1131 Chicago Tech. Bldg., Chicago, Ill.

Without cost or obligation on me please send instructive matter about opportunities in line I have marked with "X."

- ( ) Drafting (The Big Salary Course)  
No experience necessary. Free Lesson sent now.  
( ) Building Trade Course  
For men in the building lines.

Name .....

Address .....

Post Office ..... State .....

### Learn Cartooning

At Home—In Your Spare Time

from the school that has trained so many successful cartoonists of today earning from \$50 to \$200 and more a week. The Landon Picture Chart Method of teaching makes original drawing easy to learn. Send 6c in stamps for full information and chart to test your ability. Also state age.

**THE LANDON SCHOOL**  
1451 National Bldg., Cleveland, O.



### LEARN PIANO **FREE BOOK**

This interesting Free Book shows how you can become a skilled player of piano or organ at quarter usual cost. It shows why one lesson with an expert is worth a dozen other lessons. Dr. Quinn's famous Written Method includes all of the many important modern improvements in teaching music. Brings right to your home the great advantages of conservatory study. For the beginner or experienced player. Endorsed by great artists. Successful graduates everywhere. Sent free yet easy to understand. Fully illustrated. All music free. Diploma granted. Write today for free book.

**QUINN CONSERVATORY,** Studio 598 Columbia Road, Boston, 25, Mass.



## Free to Writers!



**A WONDERFUL BOOK**—read about it! Tells how easily stories and plays are conceived, written, perfected, sold. How many who don't DREAM they can write, suddenly find it out. How the Scenario Kings and the Story Queens live and work. How bright men and women, without any special experience, learn to their own amazement that their simplest ideas may furnish brilliant plots for plays and stories. How one's own imagination may provide an endless gold-mine of ideas that bring Happy Success and Handsome Cash Royalties. How new writers get their names into print. How to tell if you ARE a writer. How to develop your "story fancy," weave clever word-pictures and unique, thrilling, realistic plots. How your friends may be your worst judges. How to avoid discouragement and the pitfalls of failure. How to Win! This surprising book is absolutely free. No charge. No obligation. Your copy is waiting for you. Write for it now. Just address

## EARN MONEY AT HOME

YOU can make \$15 to \$60 weekly in your spare time writing show cards. No canvassing or soliciting. We instruct you by our new simple Directograph system, pay you cash each week and guarantee you steady work. Write for full particulars and free booklet.

**WEST-ANGUS SHOW CARD SERVICE LIMITED**  
Authorized Capital \$1,250,000.00

63 Colborne Building Toronto, Can.

### Money Making Opportunities

#### FOR INVENTORS

**INVENTORS'** educator. 900 mechanical movements, 50 perpetual motions. How to procure and sell patents. Mechanical movements greatly assist inventors, suggest new ideas. Explain how to select an attorney and avoid patent sharks. Price \$1.50. Postage free. Albert E. Dietrich, 681 Ouray Building, Washington, D. C.

**PATENTS**—Write for Free Guide Book and Evidence of Conception Blank. Send model or sketch of invention for free opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 156 Ninth, Washington, D. C.

**INVENTORS**—Send your ideas for manufacturing development to our modern sheet metal and angle-iron fabricating plant. Those pertaining to dust collecting or ventilating preferred. Liberal payment for accepted inventions. Kirk & Blum Manufacturing Co., 2845 Spring Grove Ave., Cincinnati, Ohio.

**I SELL** patents. Established in 1900. Charles A. Scott, 773P8, Garson Avenue, Rochester, New York.

**TO sell** your patent, write me. Experienced handling, immediate action. Address Arthur S. Billings, Suite 401 Dekum Bldg., Portland, Oregon.

**UNPATENTED** ideas can be sold. I tell you how and help you make the sale. Particulars free. Write W. E. Greene, Jenifer Building, Washington, D. C.

**INVENTIONS** commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 St. Louis, Mo.

**BE an inventor.** Our course of "Inventive Science" teaches you to successfully invent and sell your ideas, including patent laws, mail order business, and discussion on perpetual motion with photographs. Introductory price \$1. Inventive Science, 406 N. Denver St., El Dorado, Kansas.

**INVENTION** Magazine. Helpful advice. Send for circular. M. K. Burchett, 1430-S University Ave., New York City.

**GET Your Own Patent.** Form Free. Cooper Cutting, Campbell, Calif.

**IF you have** a practical, useful invention to sell (patented or patent pending), write us today. American Patents Corporation, Barrister Building, Washington, D. C.

#### PATENT ATTORNEYS

**PATENTS**—Before disclosing an invention the inventor should write for our blank form "Record of Invention." This should be signed, witnessed and returned to us together with model or sketch and description of the invention and we will give our opinion as to its patentable nature free. Our Three Books mailed free to inventors. Our illustrated Guide Book, "How to Obtain a Patent" contains full instructions regarding patents. "List of Patent Buyers" sent free, contains unsolicited letters from manufacturers and others who are constantly writing us regarding the purchase or leasing of meritorious patents. Victor J. Evans & Co., 937 Ninth, Washington, D. C.

**INVENTORS**—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, 232 Ouray Bldg., Washington, D. C.

**MONROE MILLER,** Ouray Building, Washington, D. C., patent attorney, mechanical and electrical expert. Best quality of work and results. Moderate charges.

**PATENTS,** trade marks, copyrights. Prompt, personal, reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

**PATENTS.** Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F Street, Washington, D. C.

**PATENTS** procured and trade marks registered. Advice and terms upon request. Robb, Robb & Hill, 1336 Hanna Building, Cleveland, Ohio. 840 McLachlen Building, Washington, D. C.

**BEFORE** or after filing application for patent on your invention it will pay you to read over my "Inventors' Adviser No. 1" free for asking. M. Labiner, Registered Patent Attorney 3 Park Row, New York.

**HERBERT JENNER,** patent attorney and mechanical expert, 624 F Street, Washington, D. C. I report if patent obtainable and exact cost. Send for circular.

**LACEY Patent-Sense.** "The book the inventor keeps." Free. See page 126.

**PATENTS PROCURED;** trade marks registered—A comprehensive experienced prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 2276-Z Woolworth Bldg., New York.

**MILLIONS** spent annually for ideas! Hundreds now wanted! Patent yours and profit. Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 501 Kresge Bldg., American Industries, Inc., Washington, D. C.

**H. F. Lowenstein,** registered patent attorney, Technical expert. 817 McLachlen Building, Washington, D. C.

**EDWARD C. SASNETT,** formerly a Principal Examiner U. S. Patent Office. Personal Service. 530 McGill Bldg., Washington, D. C.

**INVENTORS'** Guide free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer, 15-8 Park Row, New York.

**INVENTORS:** Record invention legally before disclosing to others. Our invention-record and data-sheet shows how. Sent free and valuable information given on patent procedure, costs, etc. Report on patentability includes copies of patents nearest your idea. O'Connell & O'Connell, 401 Jenifer Building, Washington, D. C.

**PATENTS**—My fees in installments. Advice book free. Frank Fuller, Washington, D. C.

**WRITE** us about protecting your invention. H. L. Woodward, Patent Attorney, 710 9th, Washington.

**More Money Making Opportunities  
on pages 6 to 24**



# Tighten Your Grip on a Trade

## Be An Electrical Expert At \$75 to \$200 a Week

Every up-to-date fellow knows what a future there is in electricity.

Big pay—fascinating work on land or sea—rapid advancement in a field where jobs are ten times more numerous than trained men to fill them, where \$75.00 a week is just a fair starter, where top notchers pull down ten thousand dollars or more a year—in a field, where any man if he wishes, can easily have a business of his own, have men working for him, **be his own boss!**

But what the average young man does NOT know, is what a simple, easy, A-B-C sort of a job it is to get started.

### You Can Start Right Now!

Yes, you. You don't need a thing you don't already have! You can read. You can write. You can figure. You can think. And in your breast is the fire of ambition—the desire to get ahead! All right, that's all you need—we can help you just as you are—just as we have helped scores, yes, thousands of other two-fisted young fellows determined to get out of the rut and into the electric field—into work that will be pleasant—easy—and all in your home, during spare time.

### Fascinating Home Study As You Hold Your Old Job

With the help we will give you, you can slip right into one of these big pay—he-man jobs and never lose a day's work. After a few weeks' start, you can earn enough in installation and electric repair jobs alone to more than pay for the Course and lay a foundation for an Electrical Contracting or Repair Shop Business of your own. When the proper time comes, we will tell you the easy way to go about doing it.

### The Most Practical, Thorough and Condensed Electrical Course Ever Written

This is the only home study electrical course that gives you the combined practical and theoretical training you must have before you can be a successful electrician without which you cannot succeed—with which you cannot fail.

Written not by ONE man, with the narrow one-man viewpoint, but by 22 of the brainiest, most successful, electrical experts ever drawn from the field of practice and theory. Gives you the complete mastery of the subject—qualifies you as electrical expert to boss jobs—fits you right into the kind of a job you want—and does it in shortest time—at lowest cost—with the

### Most Binding Guarantee of Results Ever Offered!

Satisfaction guaranteed or no sale! We not only SAY we can make you an electrical expert, we Guarantee it! If you are not absolutely satisfied when you have finished our Practical Electrical Course, we will refund every nickel you sent us.

**FREE!** Experimental Outfit Worth \$30 Find out all about our offer. Find out about the thousands who have taken this course in preference to all others and MADE GOOD. Find out about the Electric Library—four elegant volumes—worth \$25, but free. About the free Drafting Course worth another \$30. The free Experimental and Demonstration Outfit, including a real, not a make-shift Electric Motor, Wheatstone Bridge, etc.—the most scientific, high-grade and complete Experimental Outfit ever supplied with a Course in Electricity. Get all the facts without obligation, without expense! Just send the coupon!

## American School

Dept. E-875

Drexel Ave. and 58th Street, Chicago

American School,  
Dept. E-875, Chicago

Please rush all information relative to your Course in Electricity. This obligates me in no way whatever.

Name.....

Address.....



**FREE  
Electrical  
Coupon**



# How You Can Make Money In Your Spare Time

## By Learning to Play Your Favorite Musical Instrument This New, Easy Way

I BOUGHT a house and a lot, and paid \$1,100 toward it; all earned through teaching piano," writes Mrs. Mary A. Olsen, 3715 Wadsworth St., Los Angeles, Calif. "I would not take \$1,000 for my financial and social gain through your lessons. I don't know how you can give as much for so little. I think your method is just wonderful."

Mrs. Olsen is only one of more than three hundred thousand men, women, and young people who have become accomplished musicians through this wonderful new method. All the intricate "mysteries" of music have been reduced to a system of amazing simplicity. Every step is made as clear as A, B, C. You don't have to know anything whatever about music. You learn to play your favorite instrument right in your own home, quickly, easily, and without endless study and practice. Long before you now think it could ever be possible, you will actually play well enough to be in demand as a well-paid entertainer, teacher, or musician.

### \$10 to \$40 in Two Hours

A busy mother, Mrs. Anna M. Lewis, of Northfield, O., recently learned to play the violin in just a few odd moments she could spare from her household duties, and now earns many welcome dollars to help clothe and educate her four children. "At weddings and church socials I get from \$10 to \$40 for a couple of hours' playing," she writes. "I am invited everywhere, and my home is so much happier."

The new way is fun, not drudgery—You'll begin to play melodies almost from the start. You don't have to pin yourself down to regular hours and regular classes. You practice whenever you can, and learn as quickly as you please.

### Save Months of Time

"I have learned to play better than many a conservatory student in easily one-eighth the time," writes Miss Kitty Breany, 154 Warren Street, Paterson, N. J. "The lessons are so interesting that they seem like play. A lady I know spent \$400 for a private teacher, but her playing can not begin to compare with mine."

You can do what Miss Breany has done. Youngsters of from ten to twelve years have done it, and people as old as sixty have found new interest and enjoyment in learning to play a musical instrument. You don't have to listen while others entertain. You can be the talented person who is the center of attraction; who holds the audience fascinated; who wins the applause—and the dollars.

### Plays in Orchestra and Band

"In three months I was playing saxophone in the high-school orchestra. The fourth month I organized a profitable orchestra," writes George Johnson, 402 Newton St., Salisbury, Md. "And now, at college, I play in concerts of the Musical Club in New York, Philadelphia, Atlantic City, etc."

### Learn to Play Any Instrument

Piano	Cello
Organ	Harmony and
Violin	Composition
Drums and	Sight Singing
Traps	Ukulele
Banjo	Guitar
Tenor	Hawaiian
Banjo	Steel Guitar
Mandolin	Harp
Clarinet	Cornet
Flute	Piccolo
Saxophone	Trombone
Voice and Speech Culture	
Automatic Finger Control	

### Three Months from Today You, Too, Can Play

Is it the piano that you wish to play, or the organ, violin, guitar, harp, or cello? Do you want to learn to sing from notes? Are you eager to play "jazz" on the banjo, clarinet, saxophone, trombone or the drums and traps? Does the cornet call to you or the flute or piccolo? Would you love to learn the ukulele (the Hawaiian steel guitar)? Choose your favorite—and play it three months from today.

You will learn by note—the only practical way for you to learn. There are no "numbers" and no "tricks"

In this marvelous method. You learn to read your notes just as you are able to read the letters that make a word, and you will be able to recognize and play them so that they will make a melody. You learn harmonies like you learn phrases and expressions of speech and you learn time like you learn pronunciation.

### FREE Book and Sample Lesson Explain All—Send To-day

Send for this free, valuable book, "Music Lessons in Your Own Home." It costs you nothing. You obligate yourself in no way whatever. With it will be sent, a sample lesson which proves better than words, how delightfully quick and easy the famous Print and Picture Method is.

It will tell you how you can make music a delightful hobby or a money-maker for your spare hours; how you can take the first steps to a profitable musical career if you are dissatisfied with your present life-work; how you can be a social favorite, and go everywhere or have fun at home; how you can do these delightful things quickly, easily, and at a cost so low that it will surprise you.

### Special Short-time Offer

This Free Book also tells about a Special Short-time Offer now being made to music lovers. Mail the coupon at once for your copy. Act now before the supply is exhausted!

U. S. School of Music, 811 Brunswick Bldg., New York City

U. S. SCHOOL OF MUSIC, 811 Brunswick Bldg., New York City

Please send me your free book "Music Lessons in Your Own Home." Sample Lesson, and particulars of your special offer. I am interested in the following course:

(Name of Instrument or Course)

Name..... (Please Write Plainly)

Address.....

City..... State.....

## \$25.00 in Prizes

See top of page 6 in front of book for full details.

### BE AN ARTIST

#### BIG PRICES PAID FOR DRAWINGS

Turn your talent into money. We can teach you drawing in your home during spare time. Well-trained artists earn from \$40 to \$200 a week. Thousands of publishers and advertisers need the work of good artists. The MODERN METHOD is an easy way to learn to draw original pictures. Write today for full particulars showing opportunities for you. State your age.

MODERN INSTITUTE OF ART  
7 East 42nd Street Dept. 41 New York City

### FREE LESSONS EXPERT AUTO and MOTOR WORK

\$45 to \$90 A WEEK  
Boys, Men—  
16 up write  
At Once

COUPON  
Name.....  
Address.....

## Use Forceful English

### in your Letters, Talk and Advertising

#### 3 GREAT BOOKS (Pocket Size)

By PROF. MANLY (Univ. of Chicago) and J. A. POWELL  
will show you how to write and speak perfect English.  
Non-technical. Full of examples. Per copy, \$1.00.

#### BETTER BUSINESS LETTERS

#### BETTER BUSINESS ENGLISH

#### BETTER ADVERTISING

Money back in 6 days if not satisfied.  
Send for catalog of 150 Home-study Books.

F. J. Drake & Co., Pubs., 1003 Michigan Av., Chicago

## The Vest Pocket Lawyer

A complete law course—clearly analyzed in understandable English. It is a daily guide—a manual of reference for the business man—the law student—the justice of the peace—the notary public—the farmer—the clergyman—the merchant—the banker—the doctor. 360 pages. 112 legal forms. Price, postpaid, \$1.50.

POPULAR SCIENCE MONTHLY

225 West 39th Street New York



### U. S. School Student Wins \$1,000.00 Prize

I have completed my two years' course of music on the cornet, and I am ready for my certificate. I am a student at New York Military Academy, Cornwall on Hudson, N. Y.

I won my tuition with my horn for this year, worth \$1,000. Will also make it for 1924.

I am a member of the school band. For reference you can write there. I took up the baritone at midyear to give the band better service. I can fill the place of many of the players with three-valve instruments. I expect to make my living out of music when through school.

HARRY W. FULTON,  
512 Pruner Street, Osceola Mills, Pa.

## Money Making Opportunities

### AGENTS AND SALESMEN WANTED

BIG Money in spare time for one man in each locality making embossed show cards and price tickets for stores and others. Easy, quick work. No training needed. New embossing machine does it all. 400% profit. Signs sell on sight. T. W. Cushing of Chicago sold \$76 first call. S. D. Downes averaged \$15 a day for 6 months. Many sell \$5 to \$20 daily. No speculation. Before you invest a penny we send you free sample cards to show merchants and convince yourself they sell at sight. Write today. Prismaflex Corporation of America, Dept. 400, Geneva, New York.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists Accessories Company, Mansfield, Ohio.

ONLY one sale a day means \$200 per month! Five sales \$1,000 per month. Marvelous new adding machine. Retail \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides automatically. Speedy, accurate, durable, handsome. Five year guarantee. Offices, stores, factories, garages buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial offer. Lightning Calculator Co., Dept. P, Grand Rapids, Michigan.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

MAKE \$25 to \$50 week representing Clows' Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clows Company, Desk 24, Philadelphia, Pennsylvania.

GREATEST sensation! Eleven piece toilet article set selling like blazes at \$1.75 with \$1.00 dressmaker's shears free to each customer. Spring rush on. Foster Reid Co., 37 Winslow Bldg., Station C, Chicago.

HERE'S a business requires only table room. We start and help build business. Work for us painting landscape photo print pictures. No experience. We furnish outfit. Free literature. Tangley Co., 195 Main, Muscatine, Iowa.

GET our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F, St. Louis, Missouri.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Company, Dept. 467, Amsterdam, New York.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stalbrit Company, 1115 Second Avenue, New York.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

BIG fast profits for agents. Repeater Six Fuse Plugs sell on sight wherever there is electricity. Do away with lighting troubles. Welcomed everywhere. Get details. Sample 25c. Moss-Schury Manufacturing Company, Inc., 15-A, Detroit, Mich.

EVERYBODY uses extracts. Sell Duo Double Strength Extracts. Complete line household necessities. Big repeaters. Write today. Duo Co., Dept. E66, Attica, N. Y.

INSTANT Rubber Weld—Repairs largest punctures without cement or heat. Lenn's profit one day \$56. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

EARN Big Money Fast applying gold initials to Autos. Every owner buys—\$1.35 profit on \$1.50 sale—particulars and samples free. Write quick. Lithogram Co., Dept. 30, East Orange, N. J.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

POLMET polishing cloth cleans all metals; sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

AGENTS: Big money selling Clean-em, crystal washing marvel. Sample free. H. H. Shields, 1938 Telfair St., Augusta, Ga.

WONDERFUL Invention—Eliminates all needles for phonographs. Saves time and annoyance. Preserves records. Lasts for years. 12,000,000 prospects. \$15.00 daily. Free sample to workers. Everplay, Desk 1126, McClurg Bldg., Chicago.

SALESMEN, secure exclusive protected territory, high class, permanent business, worth \$10,000 yearly. Only small capital needed, no risk. Address Box 1336, New Haven, Conn.

\$742 LAST month for Beck, of Buffalo, introducing latest advertising plan; nothing else like it; every merchant wants it; easy sales; no deliveries; no collections; specialty salesmen write quick for offer. National Adv. Service, P. O. Box 39, LaGrange, Indiana.

50% PROFIT selling name cards, penknives, stationery, catalog. Wolf Labels, Station E, Philadelphia.

SELL Madison "Better Made" shirts direct from our factory to wearer. No capital or experience required. Easily sold. Big profits. Write for free samples. Madison Mills, 503 Broadway, New York.

EARN \$10 daily silvering mirrors, plating and refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. F. Decie Laboratories, 1133 Broadway, New York.

BIG money in the sale of stock for the Southern Chemical Company. Write for particulars to the Arkansas Products Company, Cardwell, Missouri.

More Money Making Opportunities on pages 6 to 24

Copyrighted material



# Makes Sensational Advance in Teaching Electricity

The achievement of Chief Engineer Smith, of the S. & H. Electrical Works, Chicago, is a great step forward in fitting men for the big jobs in electricity. He has invented the Shop Type Training System of teaching actual shop practice of electricity right in your own home. Mr. Smith is turning out expert electricians in an amazingly short time and by a brand new method that makes it the most fascinating study in the world.



## Fits Men for \$3,000 to \$10,000 Jobs By New Plan of Home Training

**I**T IS now made possible for an average man, regardless of education or experience, to be trained for the really big pay jobs in electricity. Everyone knows that a man must know shop methods to fill an electrical job. He must have the real practical experience such as our Shop Type System of Home Training gives him. At the end of this course he can be the confident, efficient electrical man, at home in the largest electrical plant. He is trained, experienced and fitted to step in where a man of authority and responsibility is needed to direct others. No wonder the electrical men are uniting in praise of Mr. Smith's accomplishment. Electricity needs these Shop Type trained men and jobs are waiting that pay all the way from \$3,000 to \$10,000 a year and even higher.



### Men Needed

You can easily realize why Mr. Smith has constant requests for men trained by this new method. An employment service has been developed to take care of this demand, and this service is given free to S. & H. graduates.

Never before has there been such an opportunity offered to get into the big pay field of electricity—that fascinating work that lifts men above the common rut, pays them big salaries, sends them to the most interesting parts of the world, gives them an unlimited opportunity for advancement and a place in the affairs of the world.

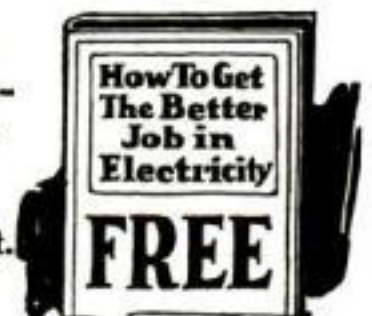
Mr. Smith has made it all so easy. You can easily qualify by spare time study in a few short months. Everything is so thoroughly explained and so wonderfully illustrated by original cuts, pictures, diagrams, plans and designs—and Mr. Smith's own personal supervision is so thorough—that you cannot help but grasp every step of the work. Mr. Smith is so anxious that every ambitious man who really wants to learn electricity be given the opportunity that this course is offered at no advance in cost over the older methods.

### Free Outfit

To all who send the coupon below at once Mr. Smith is now offering free a complete outfit of S. & H. Shop Type electrical apparatus, instruments and appliances for experimental and practical home shop work. By sending the coupon below you will be entitled to this offer—but you must send it immediately. You do not want to lose a day's time in taking this Shop Type Training and equipping yourself for electrical work, and when you enter this profession you cannot afford to be without the prestige and backing of the S. & H. Electrical Works, where we actually do all the things which we teach you. Now is the time to act—don't take a chance to lose this big free offer. Get the information that will open a wonderful career to you. Mail the coupon now for big free book, "How to Get the Better Job in Electricity."

S. V. Smith  
S. & H. Electrical Works

Dept. N-16  
1422 W. Monroe St.  
Chicago, Ill.



### Every Branch of Electricity

No matter what phase of electricity you want to learn or what field you expect to enter, you will find it in S. & H. Shop Practice of Home Study. You are taught all types of electrical work, such as house wiring (paying \$8.00 a day up), central and sub-station operating and maintenance (\$2,500 to \$10,000 a year), automobile and tractor start, lighting and ignition (\$35.00 to \$85.00 per week), electrical jobs and battery station service (\$40.00 a week to \$10,000 a year). You are taught motor maintenance, armature winding, illuminating engineering and lighting construction. You are fitted to start right out and make good at any of these jobs. Best of all you are fitted for the big pay jobs at the top of your profession.

S. & H. ELECTRICAL WORKS,  
Dept. N-16, 1422 W. Monroe St.,  
Chicago, Illinois.

Please send me free electrical book and full particulars of your course of Shop Type Training in practical electricity and full details of your free offer to those who enroll now. I understand this is free of charge and does not obligate me in any way.

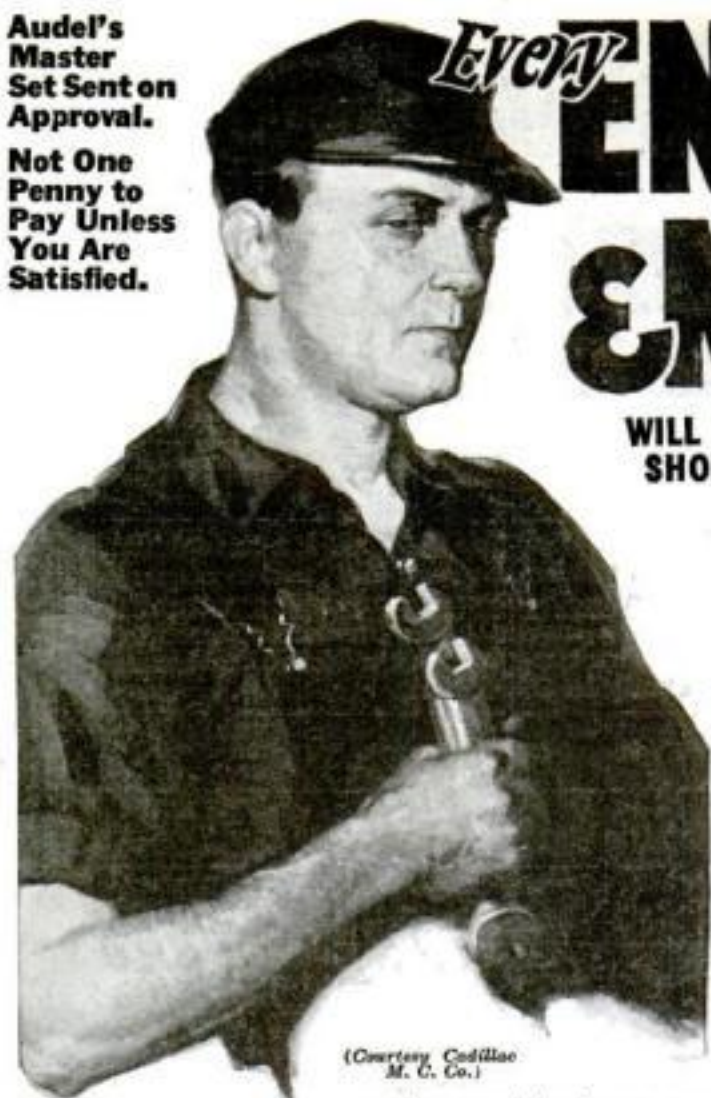
Name.....

Address.....

City..... State.....



**Audel's Master Set Sent on Approval. Not One Penny to Pay Unless You Are Satisfied.**



(Courtesy, Codillae M. C. Co.)

# Every ENGINEER & MECHANIC

**WILL FIND PRACTICAL INFORMATION ON SHORT CUTS AND MODERN METHODS IN**

## AUDEL'S ENGINEERS & MECHANICS GUIDES

**AUDEL'S GUIDES ANSWER YOUR QUESTIONS IN A PRACTICAL WAY**

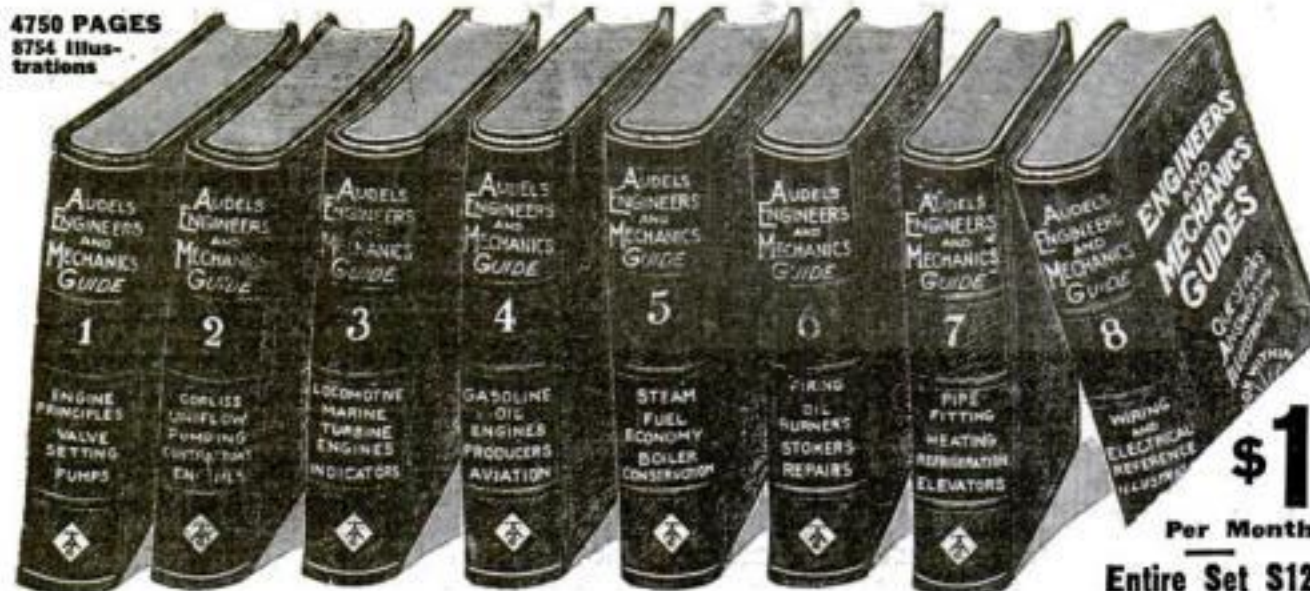
**YOUR FOREMAN WILL QUICKLY NOTICE THE SUPERIOR QUALITY OF YOUR WORK**

**Every Engineer, Mechanic, and Electrical Worker will welcome this new master set. It will answer your problems.**

**It will help you with your daily work.—A sure source of advancement and higher pay. Complete up-to-date information that is thoroughly and**

**easily explained on every branch of modern engineering and electrical practice. The entire set costs you only twelve dollars—knowledge and instruction that has cost thousands of dollars and years of time—yours for \$12.00—\$1.00 a month.**

**4750 PAGES  
8754 Illustrations**



### QUESTIONS AND ANSWERS TEACH YOU QUICKLY

**HOW TO MAKE SHORT CUTS—HOW TO HANDLE THE JOB THAT PUZZLES YOU**

**Study this Brief Table of Contents:** Theory, Practice and Operation of ALL Steam Engines, Valve Motions—VALVE SETTING: complete information on All engines and pumps—CORLISS ENGINES and the Theory, Construction and Operation of all Steam Engines, including UNIFLOW and POPPET VALVE ENGINES, and LOCOMOBILES—Locomotive-Marine Engines: Turbines: Rotary Engines—the Indicator—Lubrications—PRACTICAL MANAGEMENT. How to use Indicator—GAS, GASOLINE, OIL, SEMI- and FULL DIESEL ENGINES—Aeroplanes and Aviation—HOW TO SELECT AN ENGINE, working instructions, drawings on STEAM ENGINE DESIGN, including rules and formulae, Theory and Construction of ALL Steam Boilers; Heat - Combustion; Fuel and Flue Gas An-

alysis—CO<sub>2</sub> recorders—Characteristics of Boilers—Materials—Construction of all types of Boilers. (THE LATEST PRACTICE.)—Boiler Construction—Mechanical Stokers—Oil Burners—Setting—Chimneys—Mechanical Draught—HOW TO SELECT A BOILER—Complete instructions and drawings on BOILER DESIGN based on A. S. M. E. BOILER CODE—OPERATION, including installation, FIRING; care and repair of Steam Boilers—Pipes, Fittings and Pipe Fitting—Heating and Ventilation—Refrigeration—Cooling Towers—Condensers—Distilling Apparatus—Elevators—Cranes and Hoisting Machinery—Ropes and Cables—Splicing—electric wiring in ALL branches; compendium of practical electrical engineering as an aid for engineers and electricians in obtaining a license—57 chapters—ready reference index, covering entire field of Modern Electricity.

### POCKET SIZE—FLEXIBLE COVERS—8 NUMBERS

**TURN SPARE TIME INTO CASH BY STUDYING THE GUIDES**

Take a volume with you wherever you go. They can be easily slipped in and out of your coat pocket without damage. Study the questions and answers. In fifteen minutes a day study you will in a few weeks acquire information that will make you a more valuable man.

# FREE EXAMINATION

**Not a cent to pay until you see the books. No obligation to pay unless you are satisfied. Send coupon now—today and get this new master set for engineers.**

**PAY ONLY \$1 A MONTH.**

## Money Making Opportunities

### AGENTS AND SALESMEN WANTED

**MONEY** manufacturing these biggest selling specialties in your own home, office, shop from Miller's Guaranteed Manufacturer's Formulas for all lines. Investment small. No machinery required. Stamp brings by return mail detailed information relative to manufacturing delicious Summer Drinks, Pure Food Products—full line, Launderite, Washing Marvel, Non-Thermic Ice Saving Cloth, Zebest Stain Remover, 30-minute Beauty Clay, Hair-Silk, Marceline Curling Liquid, Amazon Rubber Repair, Toy Rubber Balloons and many other profitable money-makers. Don't confound these high class processes with the "junk" offered by others. I have been 26 years supplying the best. Miller, Industrial Chemist, Tampa, Florida.

**AGENTS** Wanted—Something New—Fire Fighter sells easily. Makes a spectacular demonstration; car owners, homes, factories, stores practically buy on sight. Our men make \$10.00 to \$50.00 a day; exclusive territory. If you wish to establish a business of your own with unlimited possibilities for making big money, write us today. Fyr-Fyter Co., 191 Fyr-Fyter Bldg., Dayton, Ohio.

**AGENTS**—Complete line of toilet preparations, including Beauty Clay, Hair Gloss, Lemon Creams. Every woman a user. Colonial Chemical Co., 631 Penn Ave., Pittsburgh, Pa.

**SHEEP** wool moccasins, polishers, dusters, Box 26, East Boston, Mass.

**AGENTS** make 500% profit handling auto monograms, new pictures, window letters, transfer flags, novelty signs. Catalog free. Hinton Co., Dept. 125, Star City, Indiana.

**STAMPING** names on emblem key checks. Sample 20c. Key check outfit, steel dies, key cases, etc. Service Sales Corporation, Shelby, Ohio.

**AGENTS**—Stop wishing; work; you can make \$10.00 daily selling articles everybody needs. Particulars free. Write B. & G. Rubber Company, Dept. 446, Pittsburgh, Pennsylvania.

**MAKE \$31.00 Profit**—Cost you \$150 Complete Gold Monogramming Outfit. Transferred instantly on Automobiles, Trunks, Bags, Windows. Experience Unnecessary. "Free Samples." Nullife (B) Monogram, Hartford, Conn.

**AGENTS**—Clever Invention! Inkspoon makes every pen a fountain pen. Fast office seller; big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marui Company, Tribune Building, New York.

**AGENTS**—15 a day—Easy, quick sales—Free auto—Big weekly bonus—\$1.50 premium free to every customer. Simply show our beautiful 7-piece, solid aluminum handle cutlery set. Appeals instantly. We deliver and collect. Pay daily. New Era Mfg. Co., 803 Madison Street, Dept. 41A, Chicago.

**\$60-\$200 A WEEK.** Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434A North Clark, Chicago.

**AGENTS** Wanted—"10 A Day and More," our new book, shows clearly how you may gain sure success and large profits selling Guaranteed Hosiery and Underwear. Factory to family. It is Free. Write today. C. & D. Company, 25-E, Grand Rapids, Mich.

**MAKE** money silvering mirrors, all kinds plating, knives, spoons, auto headlights. Outfits furnished. Free Booklet. International Laboratories, Dept. 27, 311 Fifth Avenue, New York.

**SALESMEN** can make \$5.00 a day selling our calendars, pencils, signs, advertising novelties, yardsticks, whistles, etc. Liberal terms. Sells entire year. Fine side line. Local and traveling agencies. Model Calendar Co., Dept. 309, South Bend, Indiana.

**EASY,** pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

**ACCESSORY** replacement-part. Most men sell 90% of calls, some earning \$100 weekly. Every auto owner and dealer interested. Bodin Mfg. Co., Allentown, Pennsylvania.

**START** and operate your own business and acquire financial independence. Openings everywhere. Either men or women. We furnish everything and show you how. Big explanatory book "The Open Door to Fortune" FREE. Ask for it now. National Scientific Laboratories, 17A, Richmond, Va.

**SALESMEN:** If you want \$6000 this year, write now. Strong line for retail stores. Nationally advertised; established concern. Liberal weekly advances to producer. George R. Williams, 1920 Euclid, Cleveland, Ohio, Dept. 201.

**AGENTS**—100% profits. Fast selling novelty for lodge members. Emblematic Belt Co., Ashland, Ohio.

**BIG** money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50—make \$1.44. 10 orders daily easy. Write for information and free samples. World Monogram Co., Dept. L, Newark, N. J.

**FORDS** use kerosene and start instantly. Amazing invention. 200% profit. Territory going. Write Super, 1304-119 Fondulac, Milwaukee, Wis.

**SOMETHING** Really New in honest merchandise. Every home needs one. Big profits. Sample 25c. Information free. Chas. Whitehead, Cochran, Penna.

**START** your own business as our sole agent, selling 100 famous home products. All or spare time. Dr. Blair Laboratories, Dept. 525, Lynchburg, Va.

**AGENTS**—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freepost Mfg. Co., 24 Main Street, Brooklyn, N. Y.

**WE** start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., Dept. 21, St. Louis.

**NEW** invention; reduces gas bills 50%; big money for agents, write quick. Allied Products, box P. S., Waterloo, Iowa.

**FREE** Sample "Rain Shield Wiper." Retail \$1.00—Costs (25c). Sold Clear and Rainy Days. No Cloth—No Paste—No Attachment. (1) Rub keeps Windshield Clear (45) Hours. Experience Unnecessary. Nullife (1) Corporation, Hartford, Conn.

**AGENTS**—Free sample Dr. Elliott's Vegetable Oil Soap—19 full-sized packages right out of stock. Tea, coffee, extracts, spices, food products, laundry and toilet soap samples. Everything furnished. Send postal today. Department 62, Harley Company, Dayton, Ohio.

**CATARH,** Hay-Fever Remedy—Conquers worst cases. Sample Free. Paul Beck, Pittsburgh Building, St. Paul, Minnesota.

**More Money Making Opportunities on pages 6 to 24**

**THEO. AUDEL & CO., 72 Fifth Avenue, NEW YORK CITY**  
Please submit me for free examination, AUDEL'S MASTER SET FOR ENGINEERS AND MECHANICS. Ship at once, prepaid, the 8 numbers, total cost \$12.00. If satisfactory I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.  
Name.....  
Occupation.....  
Employed by.....  
Home Address.....  
Reference.....  
P. S. M.  
Nov. 23



# 7 Out of Every TEN People are Committing

## Nerve Suicide!



*- and don't know it!*

Millions of people are right this minute suffering with the most stealthy, deadly, frightful malady known to man—"Nerves." Yet not one person in ten realizes that anything is seriously wrong.

**"NERVE EXHAUSTION,"** in one stage or another is simply the inevitable result of using up the Nerve Force—the energy that keeps the body healthy and vigorous. Without this vital force the body becomes dull, deadened, insensible to action. Its mechanism grows tense, irritable—a prey to disease. The mind becomes tortured with doubts, fears, worries. Your ragged, shattered nerves seem to cry out in agony. You suffer untold misery. You wreck your happiness. You spoil your chances for success in business.

The **earliest symptoms** of this frightful condition are usually nothing more or less than a tired feeling, a lack of energy. In the **second stage**, it starts with a sort of nervous restlessness, poor appetite, inability to sleep soundly, indigestion, constipation, sour stomach, lack of concentration, headaches, decline of sex force. **The last stage** is characterized by serious mental disturbances; fear, undue worry, melancholia, suicidal tendencies, and, in extreme cases, insanity.

Amazing as it may seem, more than seven out of ten people today are

suffering in one form or another this subtle and dangerous malady. Widespread, prevalent, leaving few immune, this treacherous mind-breaking disease is actually undermining the health of the nation. And worst of all is the fact that not one person in ten recognizes the malady or attempts to correct it.

Science, however, now proves that there is **absolutely no excuse** for nervous disorders and the terrific damage they inflict on the physical and mental health of man.

Paul von Boeckmann, one of the leading neurologists and specialists in this country, who has diagnosed, cured and recorded over 100,000 cases of disordered nerves, now proves that this condition can be easily and completely corrected. He has analyzed and classified the causes of Nervous Exhaustion. He now shows how amazingly easy it may be relieved and permanently cured.

Already thousands of people who once were tortured with nervous disorders of every kind have, through his simple method, banished these fearsome diseases with amazing rapidity. Even after the first hour, you sense a complete change in your attitude toward life. Worry, fear, self-consciousness, the sense of inferiority, lack of confidence, shortly disappear as if by magic.

The nerves become calm, cool and rational. Pep, courage and vitality improve. You start to think logically. Concentration becomes better. Such ailments as constipation, headache, lack of appetite, inability to sleep quickly give way to health so radiant, so buoyant, you feel like an entirely new person.

The whole intricate nervous system, the way it works, and how to guard it against all trouble, is clearly and concisely explained in Mr. von Boeckmann's newest book, "The Care of the Nerves." An interesting, illuminating, 96-page treatise that costs only 10 cents, and explains everything in the clearest language. Send for it today.

**PAUL von BOECKMANN**  
110 W. 40th St., Studio 161, New York

Simply clip the coupon, fill it in, and the book will be sent to you immediately. After reading this remarkable treatise, if you do not agree that it is the most instructive book you ever read, your money will be refunded, plus your outlay for postage.

**PAUL von BOECKMANN**  
110 W. 40th St., Studio 161, New York, N. Y.

Dear Sir: I desire to investigate your method, without obligation of any kind. (Print name and address plainly.)

Name.....

Address.....

.....

Enclose 10c if you wish the book.





## 16 Latest Fox Trots and Waltzes

### FOX TROTS

1. Carolina Mammy
2. Swingin' Down the Lane
3. Yes! We Have No Bananas
4. Bambalina
5. Wild Flower
6. Harney Google
7. Carolina in the Morning
8. Who's Sorry Now
9. Mr. Gallagher and Mr. Shean
10. I Love Me
11. Parade of the Wooden Soldiers
12. Sun Kist Rose
13. You Know You Belong to Somebody Else

### WALTZES

14. Love Sends a Little Gift of Roses
15. Red Moon
16. Mellow Moon

**\$2.98**  
**For all**

## Eight Full-Size Double Face 10 Inch Records

Here is the greatest phonograph-record bargain ever offered. All **brand-new** records, right straight from factory to you! The very latest Broadway hits—the most popular dance music of **today**. All New York is dancing to these wonderful, catchy, swingy Fox Trots and Waltzes. Eight full size ten-inch brand-new records which play on **BOTH SIDES**, giving you **SIXTEEN** complete selections, **PLAYED BEAUTIFULLY** by the most wonderful **DANCE ORCHESTRAS** you ever heard! A wonderful collection of latest hits—**ALL FOR ONLY \$2.98**. Never before such a bargain in up-to-the-minute records!

**Send No Money** Try these records for 10 days in your own home. Note the beauty of recording, the catchiness of the tunes and the wonderful volume and clearness of tone. Send no money now—just give postman \$2.98 plus delivery charges on arrival. If not delighted with your bargain return records and we will refund money and pay the postage **BOTH WAYS**. This low price made possible by manufacturing in enormous quantities and selling direct to users. Do not wait! Mail coupon or postal to

Nat. Music Lovers, Inc., Dept 103B, 354 4th Ave., N.Y.

Nat. Music Lovers, Inc., Dept. 103B, 354 4th Ave., N. Y.

Please send me for 10 days' trial, your collection of 16 Fox Trots and Waltzes on eight double-face ten-inch records, guaranteed equal to any records made. I will pay the postman only \$2.98 plus delivery charges on arrival. This is not to be considered a purchase, however. If the records do not come up to my expectations, I reserve the right to return them at any time within 10 days and you will refund my money.

Note: If you also desire Prof. Morgan D. Stern's Course in Dancing including 10-inch double-face instruction record place X in square. (Price 98c.) ☐

Name.....

Address.....

City..... State.....

## Money Making Opportunities

### AGENTS AND SALESMEN WANTED

**AGENTS!** Sell rich-looking imported 36-38 rugs, \$1 each Carter, Tenn., sold 115 in four days. Profits, \$57. You can do same. Write for sample offer selling plan; exclusive territory. Sample rug, prepaid, \$1.39. E. Condon, Importer, 77 Bedford Street, Boston, Massachusetts.

**AGENTS "Cleaning Up."** Housewives everywhere talking about wonderful new invention—Perfection Pressure Cooker. Saves money, time, labor. Easy to sell. Write quick. Jubilee Mfg. Co., 14 Sta. C, Omaha, Nebr.

**MENS' Wonder Combination Rain-Overcoat.** Send \$5.00 for sample. Coat sells for \$15.00. Agents outfit free. Jogert Mfg. Co., Dept. P, 41 West 21st Street, New York.

**SALESMEN:** Sell the Steering Wheel Matchbox Holder. Fits on steering wheel. Greatest advertising specialty ever devised for motorists. Newton Mfg. Co., Dept. 37, Newton, Ia.

**AGENTS,** both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now. Connolly, 123 Liberty St., New York.

**INGREDIENTS** for one gallon "Flavan" Vanilla Flavor one dollar. Sells for eight. Hanson's Laboratory, Corona, New York.

**SALESMEN:** We pay larger commissions than any other Brush House in the country to men selling our line of Sanitary twisted la wire Brushes. Sanitary Wire Grip Brush Co., 15 Mercer Street, New York City.

**OIL or Coal?** "The Burning Question," interesting booklet discusses high efficiency residence oil burners. Copy free. Write E. L. Miller, Manufacturer Climax Burners, 34 Climax Building, Kansas City, Missouri.

**AGENTS—**Everywhere women's and children's guaranteed shoes direct to wearer. We deliver. A. P. Condon, Sales Manager, The Allen Shoe Co., 110 Summer Street, Boston, Massachusetts.

**BIGGEST** producers in the country handling our line of guaranteed Virgin-Wool tailor-made clothes at one low price of \$31.75. We supply finest Sample Outfit showing big assortment of fabrics, more than 75% of which are fine, firm-weave pure worsteds—just the character of goods most men want. We give unequalled service and deliveries, and pay big cash profits. There are other reasons. Write for them at once. Dept. 669, Goodwear Chicago, Inc., 844 W. Adams Street, Chicago.

**FREE—**Mixing bowls with Chinaware. Special agents' proposition, National Pottery, Roseville, Ohio.

**SALESMEN—**Build your own business without investment. No interference present occupation. Income trebled selling everybody our Special \$25.00 weekly accident (automobiles included). Sickness protection. Costs \$10.00 yearly, experience unnecessary. Write quickly. United Department, Newark, New Jersey.

**MAKE \$30.00** daily, taking orders for \$3.98 union-made raincoats. Factory prices. Fast sellers. Wonderful values. Your pay daily. We deliver and collect. American Eagle Raincoat Mfg. Co., 155 N. Union Street, Dept. 31, Chicago.

**AGENTS—**Why not sell us your spare time, \$12 an hour, \$19.70 daily easy for full time, introducing New Style Guaranteed Hosiery. 57 styles, 17 colors. No capital or experience required; just write orders, we deliver and collect. Your pay daily, also monthly bonus. Elegant outfit furnished. All colors, grades including silks. Mae-O-Chee Mills Company, Desk 15211, Cincinnati, Ohio.

**SELL "Amens" shirts.** Wonderful opportunity, big profits. Made-to-measure and stock shirts; finest materials. Write for details. Menain Shirt Co., 479-P East Tremont Avenue, New York.

**AGENTS \$54 a week,** travel by Auto, install New Stove Converter in country homes. Wonderful invention. Cook and bake all year without coal or wood. No gas or electricity needed. We furnish the auto. Sample free. Thomas Mfg. Co., Class 2561, Dayton, Ohio.

**FLORIST'S Plant Food Promotes Luxuriant Growth,** Prevents Diseases. Price 25 cents. Agents' Profit Large. De Muth, Camden, Michigan.

**MAKE \$120 Weekly in Spare Time—**Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$120 profit. No big investment, no canvassing. Sharpe of Colorado made \$935 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 803 Washington Blvd., Chicago.

**AGENTS—**Snappiest household line on earth. Red hot sellers, steady repeaters—100% profit, 500 lightweight, fast selling, popular priced necessities. Agent's outfit free. Get busy quick—Write today; postal will do. American Products Co., 9848 American Bldg., Cincinnati, Ohio.

**PATENTED Cigar Lighters with Glass Advertising Front.** Also Electric Cigar Moisteners. Wonderful Sellers. No Competition. Big Steady Profits. Proof, Cuts, Sales Plan Free. Drake Mfg. Co., Dept. P, Milwaukee, Wis.

**MENS' Shirts.** Easy to sell. Big demand everywhere. Make \$15.00 daily. Undersell stores. Complete line. Exclusive patterns. Free samples. Chicago Shirt Manufacturers, 241 W. Van Buren, Factory 149, Chicago.

**ANOTHER** new man is rolling the dollars home. H. E. Ellington, our Utah hustler, with only forty days' experience earns \$748.80 in that time. Just turned in a bunch of subscriptions for Alexander Motion Picture Publicity, which net him \$193.20, all sold in one afternoon. Free Sales Training Course helps you to start. We want a few more big men—with an active brain and fightin' blood in their veins. A profession for you—worthy of the name—advertising combined with motion-pictures. Try to get in! Alexander Film Co., 3385 Broadway, Denver, Colo.

### DISTRICT MANAGERS WANTED

**WORLD'S** fastest selling auto accessory! County distributors wanted; write today. G. L. W., Spring Older Co., San Diego, California.

**DISTRICT Managers.** Big profits. Men capable of organizing and managing crews of lady solicitors can easily clear \$50 to \$100 per week with the B. & G. Protector, the original and best protector on the market. Every woman between fifteen and fifty needs and buys it. B. & G. Rubber Co., 618 Penn Avenue, Pittsburgh, Pennsylvania, Dept. 447

**More Money Making Opportunities on pages 6 to 24**



## Thousands Can Draw CARTOONS Who Have Never Even Tried

Cartoonists earn from \$60 to far over \$300 a week. Why tie yourself to work that is drudgery when through a remarkable new method you can easily learn at home in spare time to draw cartoons that **SELL**?

**M**ANY are earning pitifully small salaries who could make wonderful salaries in cartooning. Briggs, Fox, Fisher, Goldberg and other leading cartoonists *earn more than the President*. Yet a few years ago many of our most successful cartoonists never dreamed they could draw a good cartoon!

### The World's Easiest, Pleasantest and Best Paying Profession

Just watch a cartoonist work. A few little lines—a couple of simple curves—a splash of black here and there—and then you see a splendid cartoon before you. With a few strokes of his pen, he has taken some little incident of his day's experience—some humorous or sad scene he has witnessed—and produced a wonderful cartoon.

### New Easy Way to Learn Cartooning

This fascinating ability to draw cartoons can now easily be *yours*—this ability which can mean so much real pleasure and profit to you. Through a wonderful new method you receive right at home through the mail a complete training in Cartoon Making, and *personal corrections on all* of your work from one of America's most prominent cartoonists!

With his help, you can in an *amazingly short time*, learn to draw the comic strips, humorous, political and animated cartoons which are in such big demand.

### Learn More About Cartooning Send for FREE BOOK

Never have cartoons been so popular. Millions of dollars were spent last year on cartoons of all kinds—and every week newspapers increase the amount of cartoons used. Get full details on the amazing opportunities in this fast growing field of Cartooning and full information on this remarkable home study method. Mail coupon for **FREE BOOKLET** today.

### WASHINGTON SCHOOL OF CARTOONING

Room 2411, 1113—15th Street, N. W., Washington, D. C.

### WASHINGTON SCHOOL OF CARTOONING

Room 2411, 1113—15th St., N. W., Washington, D. C.

Please send me without obligation your illustrated **FREE BOOKLET** on Cartooning and details of Free Offer.

Name.....  
(Write name plainly—State Mr., Mrs. or Miss)

Address.....

City..... State.....

If under 16 years, please state age.....



# Great Inventors Now Teach You Secrets of Practical Inventions

How would you like to be the inventor of the tin cap that now corks millions of bottles—and who gets a royalty on every one? How much money would you have now if you had invented the simple idea of putting a rubber tip on pencils? The inventor of the Gillette Safety Razor is said to have made as high as \$2,500,000 a year! The inventor of the tiny snap fastener last year paid an income tax of \$29,000. The man who invented the Autographic Kodak sold his patent rights for \$500,000!

**J**UST a single idea can make you independently wealthy in a short time. Little things—like the crimped hairpin, the paper safety-match, the metal-tip shoe-lace—brought their inventors hundreds of thousands of dollars. Only recently *Success Magazine* told how one woman built up a splendid business from an invention based on a little wedge-shaped piece of wood!

Couldn't you develop an invention as simple as these? Haven't you some ideas—even now—for one of these little inventions which can pay you so much money?

## What Invention Is

After all, invention is nothing more than the science of "fixing things." And how many times a day you do "fix things." A leaky faucet, a rattling window, a broken strap—you fix hundreds of things just like these almost every day. You may not know it, but when you "fix things" you are using the principles upon which Inventive Science is based.

Prove it for yourself. Here is shown a very simple problem in invention. See how quickly you can solve it. What would you put on Shaft "A" to force members "BB" to move back? Think of something you know now which can give you the answer. If you have an ordinary electric light switch you will find it in a second.

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. The truth is that invention is based upon exact laws which anyone can learn. It is merely a matter of first seeing something to be fixed and then of thinking of some principle which will fix it. That's all. The whole thing rests on being able to think inventively. The simple problem shown here proves that when you think inventively the whole science of invention becomes as easy to learn as reading or writing.

## Why More Inventions Are Needed Now

Hundreds of years ago, the world didn't need many new things. That is why few in-

ventions were made each year. But now the world has more needs, more things to be "fixed." And that is why, in the United States alone, over 50,000 inventions are patented every year!

The world wants better and cheaper light and power. It wants an electric light that will be heatless. It wants new motors that will weigh less and produce more power. It wants faster and less costly aeroplanes, motor cars, steam engines. It wants new inventions which will make cooking and housework easier; that will save time and labor in the home, the farm, the factory and the office. It wants new ideas for toys and other amusements. It wants its present inventions to be developed so that they will work better and more economically.

Surely you have at least one idea for an invention—no matter what it is—no matter how great or how small—the world will pay handsomely for even the simplest idea. Every day you see things which can be improved or which must be "fixed." Every day you can get ideas for new inventions. It can be a new kind of mechanical toy, or some device which will make your wife's housework easier. It can even be something as simple as the common nutcracker. The man who invented the Kid-die-Kar, it is reported, made over \$5,000,000!

## What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, automobile mechanics, law, medicine, as a profession. The Bureau of Inventive Science offers you the first course in practical invention ever devised, it has written down the easy-to-learn principles of Inventive Science so everybody could read them and learn to use them. You want the ability to invent—NOW. All you need, to become successful is this easy, fascinating training which will develop your ability so it will be worth real money.

## Learn Invention by Actual Practice at Home

Hitherto inventors had to work out the principles of invention alone. But at what a terrific price in long years of discouragement, lost time, wasted money! Now you can quickly learn, in your spare time at home, the secrets of invention which brought wealth and fame to Edison, Marconi and other great inventors.

Today fifteen famous inventors tell you WHAT TO INVENT and HOW TO INVENT. They tell you the secrets of invention which every successful inventor knows. They explain how to originate ideas, how to develop and perfect them, how to get patents. But they tell you even more: Thousands of inexperienced inventors have been defrauded of their rewards because they did not know



Little inventions like these have brought fortunes to their inventors



Raymond F. Yates, who with fourteen other famous inventors now makes it easy for you to learn how to invent in your spare time at home.

how to protect their patent rights. This great course tells you everything you want to know—how to sell your inven-

tion, how to get royalties—how to get the most money for your ideas.

## New FREE Book

The most fascinating part of this great new course is that it teaches invention by actual practice, right in your own home. With each lesson you are sent some problem in invention—just like the one you worked out here. This fascinating exercise in solving actual problems in invention, sharpens your instinct to fix things. Better than anything else, it gives you an unforgettable, instinctive habit of thinking inventively, which is worth more than you realize. In fact the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It explains in detail just how this course develops your ability to invent. It tells you how great inventors work, how to develop your ideas, how to get a patent, how to protect your invention, the best way to sell your invention, how to convert a simple little idea into big money, how to learn all the secrets of successful invention. It costs nothing, so send the coupon at once. This bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the principles of practical invention used by every successful inventor. Write for the FREE BOOK now.

## Bureau of Inventive Science

Dept. 211

Wisner Building, Rochester, N. Y.

BUREAU OF INVENTIVE SCIENCE

Dept. 211, Wisner Bldg., Rochester, N. Y.

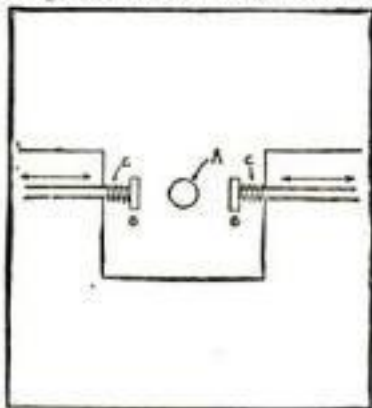
Please send me your free book, "The Science of Invention."

Name.....

Address.....

City.....

This test shows how easily you can develop your ability to invent.



Here is an interesting little problem and its solution will be found very simple, if we really think hard. "A" is the end of a shaft. The two members "BB" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "CC" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "BB" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "BB" to come forward once in every revolution. What would you suggest putting on the shaft "A"?





## \$2500 REWARD For the Capture of An Unknown Man

**T**WICE he had entered the St. Clair Mansion. What was he after? Who? What was in danger?

Berteau, the famous detective, had warned St. Clair that the mysterious marauder would come again. And now—a noise in the passage! The creak of an opening door. A shot in the dark! A capture!

Is this wounded stranger the mysterious intruder? Who could tell? Yet Berteau identified the man without hesitation and won the \$2500 reward.

How did he do it? Easy enough for the Finger Print Expert. He is the specialist, the leader, the *cream* of detectives. Every day's paper tells of their wonderful exploits in solving mysterious crimes and convicting dangerous criminals.

## More Trained Men Needed

The demand for trained men by governments, states, cities, detective agencies, corporations, and private bureaus is becoming greater every day. Here is a real opportunity for YOU. Can you imagine a more fascinating line of work than this? Often life and death depend on finger print evidence—and big rewards go to the expert. Many experts earn regularly from \$3,000 to \$10,000 per year.

## Learn at Home in Spare Time

And now you can learn the secrets of this science at home in your spare time. Any man with common school education and average ability can become a Finger Print Detective in surprisingly short time.

## Free Course in Secret Service



For a limited time we are making a special offer of a **Professional Finger Print Outfit, absolutely Free, and Free Course in Secret Service Intelligence.** Mastery of these two kindred professions will open a brilliant career for you. Write quickly for fully illustrated free book on training in detail. Don't wait until this offer has expired—mail the coupon now.

You may never see this announcement again! You assume no obligation—you have everything to gain and nothing to lose. Write at once—address

**University of Applied Science**  
Dept. 13-68, 1929 Sunnyside Ave., Chicago, Ill.

### UNIVERSITY OF APPLIED SCIENCE

Dept 13-68 1929 Sunnyside Ave., Chicago, Ill.

Gentlemen:—Without any obligation whatever, send me your new, fully illustrated, **FREE** book on Finger Prints and your offer of a **FREE** course in Secret Service Intelligence and the Free Professional Finger Print Outfit.

Name.....

Address.....

Present Occupation.....Age.....

## Money Making Opportunities

### BUSINESS OPPORTUNITIES

**YOU** can have a business profession of your own and earn big money in service fees. A new system of foot correction; readily learned by anyone at home in a few weeks. Easy terms for training, openings everywhere with all the trade you can attend to. No capital required or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

USED correspondence courses sold, rented, and exchanged. List free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

**STOP** plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

"MONTHLY Schemer." Alliance, Ohio, prints big profit schemes; one subscriber making \$25,000 from three; another \$10,000 from one. Try your luck. Year, \$1; 3 months, 25c.

**ARTIFICIAL** Marble, sanitary flooring instruction, ornamental casting, concrete plaster, papier-mache decorations, garden furniture, statuary. Rubber moulds. Electrometallurgy, particulars and 200 illustrations free. Chris Mahler, Huntington, N. Y.

**CHEMICAL** expert furnishes six manufacturing formulas with complete working directions. 50c coin. Crane Mfg. Co., Box 16, Washington, D. C.

**BANKNOTES** of Russia, Poland, Austria and Germany in denominations up to 1,000,000. Write for information on same and how to start your own business. George Grigoleit, 20 E. Jackson, Chicago.

**WE** Start you in business, furnishing everything; men and women, \$50.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime; booklet free. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

**PUBLISH** your own magazine. Everything supplied. Sample and instructions; quarter. Lebeuf, Bangor, N. Y.

**MONEY** making propositions. Particulars free. Lemke, Box 572-A, Cincinnati, Ohio.

**PATENTS** procured. Trade marks registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Bldg., New York.

**INCH** Display Advertisement 161 Magazines Thrice \$15. Year \$50. Wood's Popular Service, Atlantic City.

**UNLIMITED** possibilities, making metal toys at home. No experience required. Particulars free. New Specialty Co., 448 E. 79th St., New York.

**YOUR** Opportunity. Start a Magazine and Mail Order Business. Sample Magazine 10c. Plan Free. H. J. Teeple, Decatur, Indiana.

**FREE** Instructive Book. Start your own little Mail Order business. Home employment evenings. Also secure Agents to sell for you. We tell you how. Also furnish Beginner's Outfit circulars, samples, specialties. Book sent free. Pier, 291-A, 74 Cortland Street, New York.

**START** a real estate office of your own. Earn \$3500 upwards. Our course of 21 lessons tells you how. Booklet P. on application. Frederick Jenkins, Corlaer Heights, Schenectady, New York.

**SUCCEED** With Your Own Products—Formulas, Processes. Different, dependable, guaranteed. Catalog free. C. Thaxly Co., Washington, D. C.

**RESPONSIBLE** New York Sales Company in business 10 years will handle additional lines, technical preferred, on commission, also carry accounts. Address H. D., Room 1176, Woolworth Bldg., New York City.

**MAIL** Order News, 500 5th Avenue, New York. Explains mail order business. Copy 25c.

**SPECIAL** financial service. Obtain capital, any amount. Banking connections in United States and Europe. Incorporate your business. Sell stock, keep control. Transact any business, anywhere. Avoid personal liability. Low cost for expert services, all corporation supplies, engraved stock certificates, etc. Lists of investors, here and abroad. Write for full information. Advice free. Registrar and Trustee Co., Rochester, New York.

**BE** your own boss; \$100.00 sufficient. Handle your own cash. Dept. R. Paul Kaye, 149 Broadway, New York.

**I** HAVE over 100 stores paying \$5 monthly. You can do the same in your city. Month's practice qualifies. Midnight Alarm System, 2965 Algonquin, Detroit.

**MAKE** Big Money. Spare or full time. Everybody loves Popular Music. Few hours a day with unique plan builds cumulative income. Representatives cashing in. Reserve territory. Get particulars quick. Crocker-Steinkamp, Dept. D-11, Quincy, Ill.

**GET** ahead of the other fellow. Start a manufacturing business. Very little capital needed. Write for particulars. Universal Scientific Laboratories, Box 1871, Richmond, Va.

**LEARN** the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

### HELP WANTED

**BE** a detective. Excellent opportunity to earn big money, travel, thousands of dollars offered in rewards. Established 1909. Particulars free. Write to C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

**SILVERING** Mirrors, French plate. Easily learned; immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

**OUR** genuine gold window sign letters are an excellent money-making proposition for handy men. Slann Sign System, East Bethune Avenue, Detroit, Michigan.

**MEN**—Age 17 to 45. Experience unnecessary. Travel, make secret investigations, reports. Salaries, expense. American Foreign Detective Agency, 321, St. Louis.

**More Money Making Opportunities  
on pages 6 to 24**

## BE A RAILWAY TRAFFIC INSPECTOR

**EARN UP TO \$250 PER MONTH**

**Expenses Paid**



**What I  
Have Done,  
YOU CAN DO!**

**By J. A. SMALLICK**

After one year's work in the capacity of "Railway Traffic Inspector," I find myself in a position which *pays \$180 per month plus expenses.*

There is no doubt but what I owe my success entirely to the course taken thru the Standard Business Training Institute a little over a year ago. Due to the completeness and easily understandable language of the course, what would in other channels take years to learn can be learned in a few months.

The value of the course is explained by my personal experience. *I do not think that a quicker or greater return can be found for money invested.*

## Big Opportunities Ahead

You can begin your preparation, in spare time at home, knowing that you will enter an uncrowded profession, with many opportunities to travel, with pleasant, out-door work, with frequent contact with leading railway executives and with many chances for advancement.

## Position Guaranteed

After completing course you are **GUARANTEED A POSITION** paying at least \$110 a month and expenses or your entire enrollment fee is returned. You take no risk! The S. B. T. I. has many more openings than they can fill.

Send the coupon to the Standard Business Training Institute, Carlton Court, Buffalo, N. Y., today for Booklet No. D-64 giving full details and easy terms of payment.

**-----MAIL TODAY-----**

**Standard Business Training Institute,  
Carlton Court, Buffalo, New York**

Send me, entirely free, Booklet No. D-64, giving full particulars about course in Railway Traffic Inspection.

NAME.....

STREET.....

CITY.....





Mr. F. E. Black, Chief Radio Officer, S. S. America—a former student of the Radio Institute of America.

## Men Are Needed for Positions in Radio

You may know nothing about radio today, and yet in a few months be holding a position as radio operator—perhaps traveling to places you have always dreamed of seeing. Earning good pay at the same time. And started on a career that holds big future opportunities.

### Study at Home in Spare Time

Since 1909, we have been training the men who now hold the big jobs in radio. But there are not enough trained men today to keep up with the demand. We have therefore prepared a Home Study Course that starts with the beginnings of electricity, and goes right through the most recent commercial practice. This course prepares you for your first-class operator's license.

### There Are Positions for Every Trained Man

This Institute is conducted by the Radio Corporation of America, the greatest radio organization in the world. In choosing men for ship and shore positions, the Radio Corporation gives first preference, always, to graduates of the Radio Institute. Learn more about the course and the opportunities, by sending for our booklet.

### Advanced Radio Course

Great popular demand by the advanced student, experienced amateur and wireless operator has led to the opening of an **ADVANCED HOME STUDY RADIO COURSE**, specializing in C. W., I. C. W., telephone and radio measurements. Investigate!

### Radio Institute of America

(Formerly Marconi Institute)

Established 1909

328 Broadway, New York City

Indicate by a cross X the course you are interested in:

Radio Institute of America,  
328 Broadway, New York.

Please send me full information about radio opportunities today, and your

COMPLETE RADIO COURSE ☐  
ADVANCED RADIO COURSE ☐

Name.....

Address.....

## "I Wonder How He Knows So Much!"

How many men do you know who surprise you by the wealth of their general information and the breadth of their knowledge? If you were to inquire, you would find that nine out of ten of these men who are forging ahead make a daily habit of consulting an up-to-date Encyclopaedia. Here they have the knowledge of the centuries—accessible, concisely and plainly stated, easy to grasp and to remember.

Nine times out of ten, when you want information it is about something that has happened within the past five or six years. Nelson's Loose-Leaf is the *only Encyclopaedia* that is *always up-to-date*. By means of the loose-leaf binding device and the new pages issued every six months—to take the place of the obsolete pages—it keeps constantly abreast of the times. Form the daily habit of using Nelson's, and the store of information you will gain will make you an outstanding figure among your fellowmen

## NELSON'S Perpetual Loose-Leaf ENCYCLOPAEDIA & Research Bureau for Special Information

### THE GREAT AMERICAN ENCYCLOPAEDIA

NELSON'S PERPETUAL LOOSE-LEAF ENCYCLOPAEDIA—the Great American Reference Work—is prepared under the direction of an Editorial Staff and Advisory Board, international in its scope. The Editor-in-Chief is John H. Finley, Ph. D., LL. D., Commissioner of Education and President of the University of the State of New York (1913—1921); the Canadian Editor is Sir Robert Falconer, K. C. M. G., D. Litt., LL.D., President of the University of Toronto; the European Editor is Sir Henry Newbolt; while the Advisory Board includes men and women foremost in Scientific, Professional, and Public life in the United States and Canada, men and women who are themselves making history.

This great American Encyclopaedia is *always* an authority, in government departments, libraries, schools, and educational institutions everywhere. It covers *every field of knowledge* from the beginning of the world to the very latest activities of the present day; by means of the Loose-Leaf binding device, it is *always down-to-date*—it cannot grow old—it is always dependable.

### Nelson's Loose-Leaf—The One Encyclopaedia of Today

#### Free Educational Reading Courses

Nelson's Reading and Study Courses in CIVICS AND LAW, CIVICS AND POLITICS, LAW AND PROCEDURE, UNITED STATES HISTORY, BUSINESS ECONOMICS, NATURE STUDY, AGRICULTURE AND HOME ECONOMICS are declared by educational authorities to be equal to a college course and training in each of these departments.

#### Nelson's Free Research Bureau

FOR SCIENTIFIC REPORTS AND SPECIAL INFORMATION AND CORRESPONDENCE. Every purchaser of Nelson's is entitled to free membership in this Bureau. If at any time you are in doubt, on any subject, old or new, write to this Bureau with the positive assurance that you will promptly receive the latest obtainable and most dependable information.

#### ORIGINATORS OF THE LOOSE-LEAF REFERENCE SYSTEM

Copyright, 1923, by Thomas Nelson & Sons

#### Send for this Splendid Book

### THOMAS NELSON & SONS

#### Publishers for 125 Years

Dept. P. S. O. 381 Fourth Avenue, New York City  
77 Wellington St., W., Toronto, Canada

Please send me your portfolio of sample pages, beautifully illustrated, containing color maps, plates and photographs, and full information how, by easy monthly payments, I can own Nelson's Perpetual Loose-Leaf Encyclopaedia and receive FREE membership in Nelson's Research Service Bureau for Special Information. This must incur no obligation whatever on my part.

Name.....

Address.....

City..... State.....



# Learn Electricity



In the Great Shops of  
**Coyne**

Student Winding a Stator

## Chicago

The Electrical Center  
of the World

Come to Coyne—learn electricity in 3 months in the largest electrical school in the country. Get a complete training so you can make big money as Power Plant Operator, Superintendent, Telephone man, Construction worker, auto, truck or tractor electrician, battery man, radio expert, or you can go into business for yourself as electrical contractor, dealer, auto ignition or battery expert and make from \$3,000 to \$20,000 a year. Hundreds of our graduates today are making big money and you can do the same if you grasp this opportunity—act now.

## Learn in 3½ Months

No books or useless theory. You are trained on \$200,000 worth of electrical equipment. We give you FREE a complete course in Radio—the marvel of the age. Constructing, installing and operating. We also give you FREE a life Membership which enables you to stay as long as you want or come back for further training at any time without charge.

## Earn \$150 to \$400 a Month!

You work on motors, generators, housewiring, autos, batteries, radio, switch-boards, power plants—everything to make you an expert ready to step right into a position paying from \$45 to \$100 a week. You get a complete practical training in Circuits, Housewiring, D.C., A.C., Armature and Stator Winding, Drafting, Auto, Truck and Tractor Electricity, Battery Building and Repairing, and Radio.

### Earn While You Learn

We help students to secure jobs to earn a good part of their expense while studying.

## Send Coupon Now

Don't delay a minute—send that coupon in right now for our big free catalog and full particulars of Free Railroad Fare offer. Act now!

**COYNE**  
Electrical School

Endorsed by Electrical Industry

1300-1310 W. Harrison St., Dept. 13-68

### COYNE ELECTRICAL SCHOOL

Dept. 13-68, 1300-1310 W. Harrison St., Chicago, Ill.

Dear Sir: Please send me free your big catalog and full particulars of your special offer.

Name.....

Address.....

## Money Making Opportunities

### HELP WANTED

WANTED railway mail clerks. Free list of government positions obtainable. Men and women 17 to 45 years, salary \$1600 to \$2600. Write today for booklet, free list and sample lessons. United Business Tr. Ass'n., 8071 Dinan Bldg., Detroit, Mich.

EARN \$10.00 to \$35.00 weekly mailing circulars at home. Outfit and instructions 25 cents. Jamorris, 2305 Gratz, Philadelphia, Pa.

GOVERNMENT positions, \$1400-\$2300, yearly. Many openings. Thirty-six page information booklet free. Chicago Civil Service College, B-70, Kessler Building, Chicago.

Make money in spare time mailing letters. Rare opportunity now. Men, send addressed envelope for special terms. Normande H, 147 W 23d St., New York.

WANTED—Ambitious men to work at home. New business, local or mail order. Ordinary men make \$15-\$25 day. You can too. Interesting particulars; write Kraft, Box 896-P8, San Francisco, California.

DETECTIVES earn big money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, New York.

WANTED. \$133 month. Men 18 up. Railway Mail Clerks. Write for list positions. Franklin Institute, Dept. C41, Rochester, N. Y.

FIREMEN, brakemen, baggage men, sleeping car, train porters (colored). \$140-\$200. Experience unnecessary. 318 Railway Bureau, E. St. Louis, Ill.

\$60-\$200 WEEK. Genuine Gold Letters for store windows easily applied. Liberal offer to general agents. Metallic Letter Co., 431B N. Clark, Chicago.

RAILWAY Postal Clerks—Start \$133 month. Railroad pass; expenses paid; questions free. Columbus Institute, N-2, Columbus, Ohio.

EARN \$110 to \$250 monthly, expenses paid, as Railway Traffic Inspector. Position guaranteed after completion of 3 months' home study course or money refunded. Excellent opportunities. Write for Free Booklet, CM-13 Stand. Business Training Inst., Buffalo, N. Y.

MAKE \$25-\$75 weekly writing showcards for us at home. Simple instructions. Steady work. National Studios, 6127 Dorchester, Chicago.

WRITE photoplays: \$50 each. Experience unnecessary; details free to beginners. Producers' League, 312, St. Louis.

YOUNG men wanted at once. Become draftsmen, and earn \$50 to \$100 a week. No experience required. Big demand; splendid opportunities; clean work. Learn in spare time at home. Send for our Free Book. Just out. No charge. Address: Department 2239, Chicago Tech., 118 E. 26th Street, Chicago.

### STAMPS AND COINS

NYASSA Giraffes and packet of 52 different scarce stamps, Flume Triangle, large, \$1.00 U. S. Rev. millimetre scale, perforation gauge and ruler for only 5c. To introduce our Sudden Service approvals. Fennell Stamp Company, Dept. C, Fullerton Bldg., St. Paul, Mo.

45 DIFFERENT United States 10c; 27 different Austria newspaper stamps 15c. C. Seidenberg, Merton, Wis.

STAMPS, 20 unused. All different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

ALL different \$1.10 each. 20 Czechoslovakia, 25 Japan, 20 Lichtenstern, 25 Poland. Fred Onken, 630 79th Street, Brooklyn.

CALIFORNIA gold \$1 1/4 size, 27c; \$1 1/2 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS free! 24 British Colonials to approval applicants. Nickles, 122 Florida, Washington, D. C.

100,000 RUBLES, 25c. 10,000 German marks, \$1.00—Craig Dare, 440 55th, Brooklyn, New York.

1000 Different Stamps \$1.55; 500 55c; 300 27c. Michael 5353 Calumet, Chicago.

17 VARIETIES Bulgaria stamps, 20 cents. List of 7,000 low-priced stamps free. Chambers Stamp Company, 111C, Nassau Street New York City.

FREE—14 Ukrainia to (50%) approval applicants only. Lampe, 423 West 42nd, New York.

FREE premium to approval applicants sending 2c. Price list free. Richard Lamprecht, Dept. M, Valparaiso, Ind.

STAMPS—50 varieties, Africa, Brazil, Peru, Cuba, Mexico, etc., 10c. 50 different U. S. 25c. 1,000 hinges, 10c. 1,000 mixed, 40c. List free. C. Stegman, 5949 Cote Brillante, St. Louis, Missouri.

100 RARE and valuable foreign stamps, all different, bargain lists, and Stanton's Stamp News three months, all for 10c. Stanton, Niantic, Conn.

100 DIFFERENT stamps free to Popular Approval applicants; postage 2c. Christensen, 124 Second Street, Milwaukee, Wis.

ODD moments—odd stamps. Approvals for postal. Odd Stamp Co., Sunset Heights, Asheville, North Carolina.

OLD Coins—large Fall selling catalogue of coins for sale, free. Catalogue quoting prices paid for coins, 10c. William Hesslein, 101 B Tremont St., Boston, Mass.

158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., for only 10c. Finest approval sheets 50% to 60%. Agents wanted. Big 72-p. lists free. We buy stamps. Established 29 years. Huseman Stamp Company, Dept. 55, St. Louis, Missouri.

SEND references for best 60% approvals in America. Norman Schultz, Colorado Springs, Colorado.

FAMOUS Barney Google packet to approval applicants—only 10 cents. 83d. Desk 11a, 740 Langdon, Madison, Wis.

SET Austria, Bavaria, Bulgaria Free for 2 cent Stamp. Poste Stamp Co., 5418 Sansom Street, Philadelphia, Pa.

More Money Making Opportunities  
on pages 6 to 22



## Perfect Health Restored to You Absolutely Free

Indigestion, constipation, acidity, weak nerves, weak heart and lungs, dyspepsia, congestion, anemia, rheumatism, nervous exhaustion, hardening of the arteries, high blood pressure and every impotency and weakness absolutely and permanently overcome by this amazing Natural Law—absolutely free.

Nothing to take, nothing to give up, nothing to buy, nothing to actively practice and requires no sacrifice of time.

No exercise, dieting, drugging or conscious deep breathing—you just capitalize this marvelous Natural Law and your troubles and weaknesses leave you—you become master of your weaknesses permanently.

This Natural Law is the greatest regenerator of the human body ever discovered. It yields amazing energy, inexhaustible vitality and nerve-force—a new and superior life in body, brain, nerves and mind.

It does away with doctors, drugs, systems, cures, pills and devices by making nature do the healing.

This Natural Law is unlike anything ever used by human beings. Its discovery is absolutely new and sensational. Thousands already owe their complete restoration to it.

This Marvelous Natural Law prevents weakness and disease of heart, lungs, digestive system, nerves, etc., etc. It also regulates weight.

It is no longer necessary for anyone to remain weak and sick because supreme health and life are absolutely free through this Natural Law.

This Supreme and Natural Law is sent free to anyone above 18 years of age.

ALON P. SWOBODA,  
1161 Berkeley Bldg., 21 West 44th St.,  
New York City

Send me free the Swoboda Natural Law of Supreme Life and Health.

Name.....  
(write clearly)

Address.....

City.....

Special Note:

If you send anything to help cover cost of mailing, etc., do not send more than 10 cents. Remember this sensational Natural Law is free.



## TANGOS

5¢

a Bunte-blended, chocolate covering, thick and rich, then—marshmallow, toasted peanuts, maple cream—all in one, the tasty candy treat supreme.

*Bunte*  
Candy

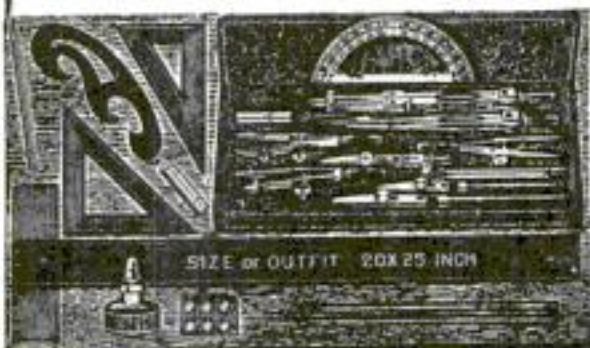
BUNTE BROTHERS · CHICAGO



# \$90 Drafting Course Free

There is such an urgent demand for practical, trained Draftsmen that I am making this special offer in order to enable deserving, ambitious and bright men to get into this line of work. I will teach you to become a Draftsman and Designer, until you are drawing a salary up to \$250 a month. You need not pay me for my personal instruction or for the complete set of instruments.

## FREE \$25 Drafting Outfit!



These are regular working instruments, the kind I use myself. I give them free to you if you enroll at once. Send the Free Coupon Today!

## Salaries up to \$250 and \$300 a Month

Positions paying up to \$250 and \$300 per month, which ought to be filled by skilled draftsmen are vacant everywhere. There are in every part of this country ambitious men, who with practical training and personal assistance, will be qualified to fill these positions. Mr. Dobe guarantees to train you UNTIL placed in a permanent position at a salary up to \$250 and \$300 per month.

## Earn While Learning

You can be earning a handsome income while learning at home. This is a special offer I am making. Absolutely no obligations of any kind in sending coupon. But you must write at once, as I limit the number of my students.

**I Guarantee**  
To instruct you until competent and in a permanent paying position at a regular Draftsman's salary of at least \$250 per month and guarantee to furnish you free complete Draftsman's working outfit at once from the start.

## Mail Coupon

at once for my book—"Successful Draftsmanship," also list of open positions and for the free offer to be earning good money at once while learning at home. This offer is limited and in order to benefit thereby—act at once.

**Chief Draftsman Dobe**  
1951 Lawrence Ave., Div. 13-68 Chicago, Ill.

## Free Course Offer Coupon

**Chief Draftsman Dobe**  
1951 Lawrence Ave., Div. 13-68 Chicago  
Without any obligation to me please mail your book, "Successful Draftsmanship" and full particulars of your liberal "Personal Instruction" offer to a few students. It is understood I am obligated in no way whatever.

Name.....Age.....

Address.....

# This FREE BOOK on RADIO

## Has Shown Thousands How to Make More Money

THIS wonderful book has opened the eyes of thousands to the amazing Big-Money Opportunities opening right now in Radio. It has shown them how they could get their share of the tremendous profits of this newest and fastest growing world industry—regardless of what their previous training or experience had been. Hundreds of men today are earning far more than they ever did before—all through having read this Free Book of Radio Opportunities, which we will mail to you without the slightest obligation on your part.

## Scores of New Opportunities Waiting for YOU In Radio!

In the entire history of industry, there probably never has been a business development which can compare with that of Radio! Within a few years it has jumped into the ranks of the world's largest and most profitable fields of endeavor. Broadcasting stations are springing up all over the country. Hundreds of thousands of receiving sets are in operation. Hundreds of ships are installing more and latest equipment. Radio is everywhere being adopted in business. \$100,000,000 was spent last year just for receiving sets alone.

This amazing expansion of Radio has opened up hundreds of new positions on land and sea. It has created opportunities never dreamed of in other fields. Big money—fascinating work—advancement—a real future in the world's fastest growing industry!

## Easy To Learn Radio At Home

If you are ambitious—if you are looking for a field where opportunities are unlimited—get into Radio. Become a Certified Radiotrician—become a highly trained specialist in a new, uncrowded profession.

Thousands of Certified Radiotricians are needed to operate broadcasting stations; to design radio sets; to repair and sell radio apparatus; to take charge of radio departments; to operate on board ship

or at commercial and government land stations; to go into business for themselves; to fill the hundreds of attractive positions in this wonderful new field.

And now you can easily and quickly qualify in your spare time at home through the help of the National Radio Institute, one of the oldest and largest radio schools in the world. Hundreds of graduates of this school are today profiting by the amazing demand for radio experts. Prominent radio experts help you in your training. Valuable radio instruments for practical instruction supplied free with the course. The same training which has helped hundreds of our students to big positions in radio is open to you.

Enroll Now—For a limited time we are offering our wonderful course at a big saving to encourage as many as possible to enroll at once and help us fill the demand.

## Big Free Book Describes Amazing Opportunities

Learn more about this wonderful field of radio and what it can mean to you. Read about the opportunities open—their pay—how our method quickly trains you—what our graduates say—what they are doing—and what you can do. There's no obligation in sending for this free book. You have everything to gain—and nothing to lose. Send for this book today—the book that has meant more money to hundreds of our graduates. Mail the coupon Now!

**NATIONAL RADIO INSTITUTE**  
Dept. 12-L Washington, D. C.

**FREE BOOK COUPON**  
NATIONAL RADIO INSTITUTE, Dept. 12-L  
Washington, D. C.

Without obligation, send me your free book "Your Opportunity in Radio," which tells all about the opportunities in Radio, how spare time study at home will qualify me quickly as a Certified Radiotrician so I can get one of these splendid positions, and how your free Employment Service helps me to secure a big pay job.

Name.....Age.....

Street.....

City.....State.....

NOTE:—Radio Firms secure practical Radio experts among our graduates. Write us to day.

## What Free Book Has Meant to Just a Few of Our Recent Graduates

**Triples His Salary As Radio Engineer**

Thanks to your course and help it gave me, I have had another boost in pay. This is the third one in less than a year. Today I am getting three times as much as I got before I began your course.

MERLE WETZEL,  
Chicago Heights, Ill.

**\$300 a Month and All Expenses as Salesman**

Your course was worth \$5000 to me, but I wouldn't take ten times that for the value I've gained from it. I signed up with a company for \$300 a month and expenses paid. I owe this to your course.

EMMET WELCH,  
Peculiar, Mo.

**Prepares For All Radio Jobs**

It will interest you to know that since completing your course I was 1st operator on Steamship Lake Giltedge. Last summer I had charge of Broadcasting Station WIAI, and in December connected with the Colin B. Kennedy Radio Corp., as sales correspondent, handling all technical inquiries which I enjoy immensely. All due to N. R. I.

WILLIAM WEST,  
St. Louis, Mo.



# STEADY JOBS at GOOD PAY



Many graduate Greer Students now own their own places of business. This means independence, no boss, and earnings of \$300 to \$5000 per month.



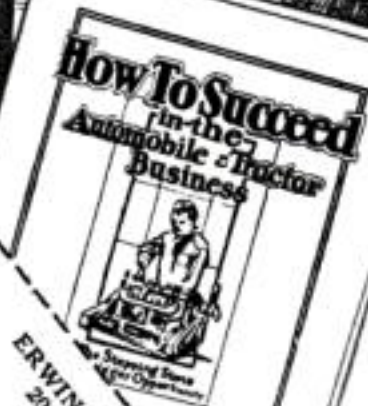
Head Automotive Mechanic's salary averages \$150 to \$500 per month, or higher. Greer Training gets you quick promotion.



The Greer-trained Truck and Tractor Repairman can always be sure of a job anywhere. Earnings run \$6 to \$15 per day and higher.



Automobile Salesmen make up to \$20,000 per year. Greer trains you to sell.



ERWIN GREER, President  
2041 S. Wabash Ave., Chicago, Ill.  
Send me your Free Book, "How to Succeed in the Automobile Business," and Special Tuition Offer.

Name.....  
Address.....

## Earn \$50 to \$125 Per Week

Record-breaking automobile sales have created thousands of \$50 to \$125 per week jobs for men practically trained in automotive work. Hundreds of requests for such men—Greer Graduates—come to our free employment bureau. We have more jobs than we have men to fill them. YOU can be next in line if you will start *right now*. Eight short weeks at Greer College will equip you to step out and make big earnings for life.

## EARN WHILE YOU LEARN JOBS GUARANTEED

If you are in need of assistance we guarantee to place you at once in a position paying up to \$30 per week. Only a small payment down on the course selected is necessary. We have helped many men to an earning competence in this way. Interesting instruction awaits you. Here in the big Greer shops you get actual work on 4, 6, 8, and 12 cylinder engines. Electricity thoroughly covered. All known Lighting, Starting and Ignition units used. Special courses in Machine Shop, Batteries, Welding and Vulcanizing. Individual road lessons given.

## You'll Be Expert on ALL THESE

Complete Greer Course includes Machine Shop Practice—Shop Management—Selling—Truck, Tractor and Automobile Repairing—Lighting—Starting—Vulcanizing—Storage Batteries—Driving—everything required to equip you for the highest paid automotive positions anywhere.

### DAY AND EVENING CLASSES

Any job we get for you need not interfere with your instruction. Day and evening classes are arranged to suit the convenience of every man who has the ambition to learn. You'll be working along with a bunch of fine, progressive fellows inspired with the determination to get ahead. Time will seem to fly. You'll be a full-fledged Automotive expert almost before you know it.

### MAIL THE COUPON

It will bring you a big FREE BOOK, "How to Succeed in the Automobile and Tractor Business." It will also bring you special Tuition Offer and complete information about jobs. Mail it *at once*.

### We Pay Your Railway Fare to Chicago

This special offering is made to fill the openings that now exist. Chicago is the place to train. The opportunities for jobs are unlimited. Within ten blocks of Greer College are at least 40 large Automobile Sales Agencies. Throughout the city are approximately 5,000 Garages and Repair Shops. We will help you find a job and a home. Write us, and come to Chicago.

# GREER

## COLLEGE

of Automotive Engineering

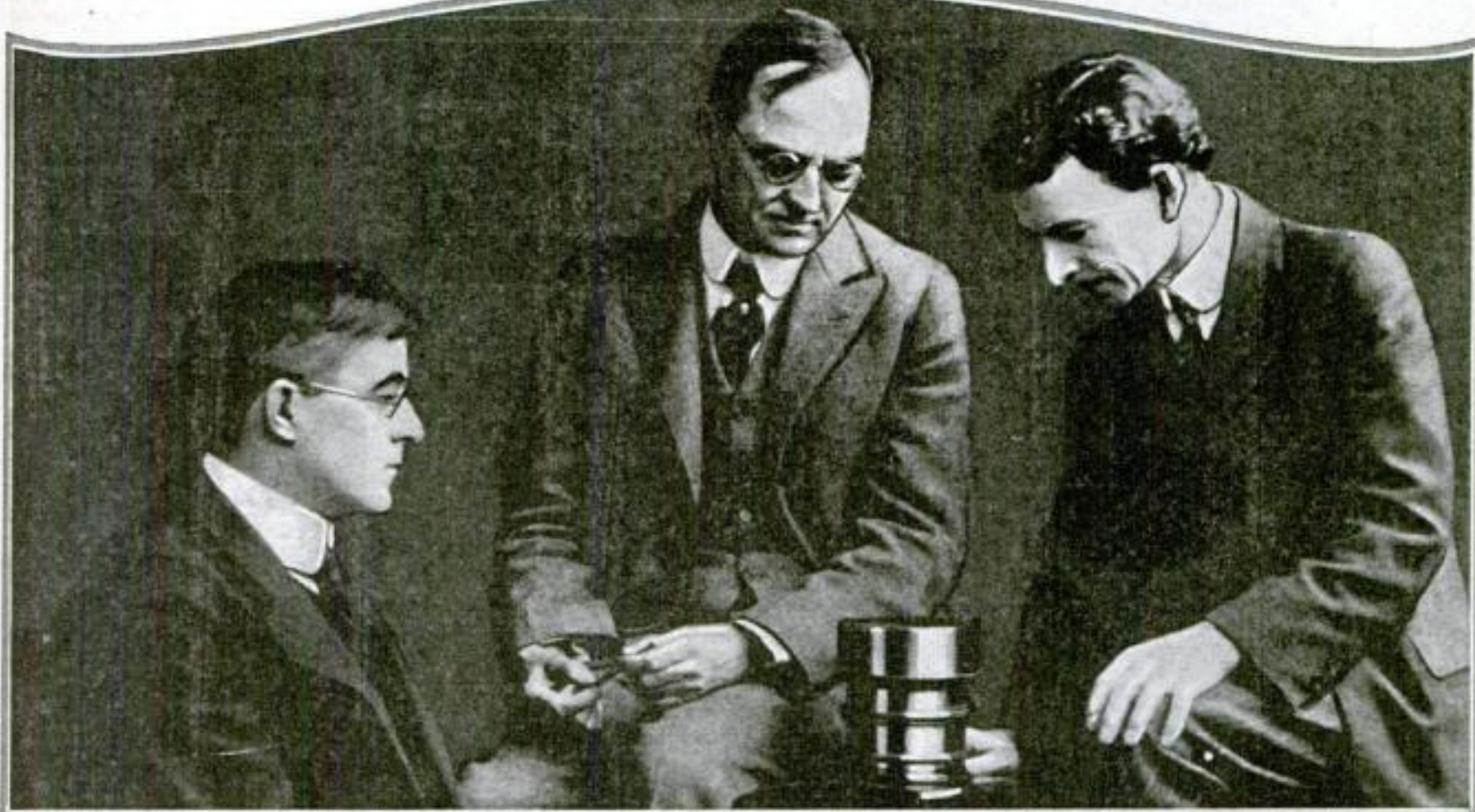
2041 S. Wabash Avenue  
CHICAGO, ILLINOIS



This magnificent new building—its 80,000 square feet of floor space filled with repair shops and modern shop equipment—is entirely devoted to training Greer Students. This is where you will prepare yourself for a lifetime of pleasant work at big pay.



# Men of the Hour in Science



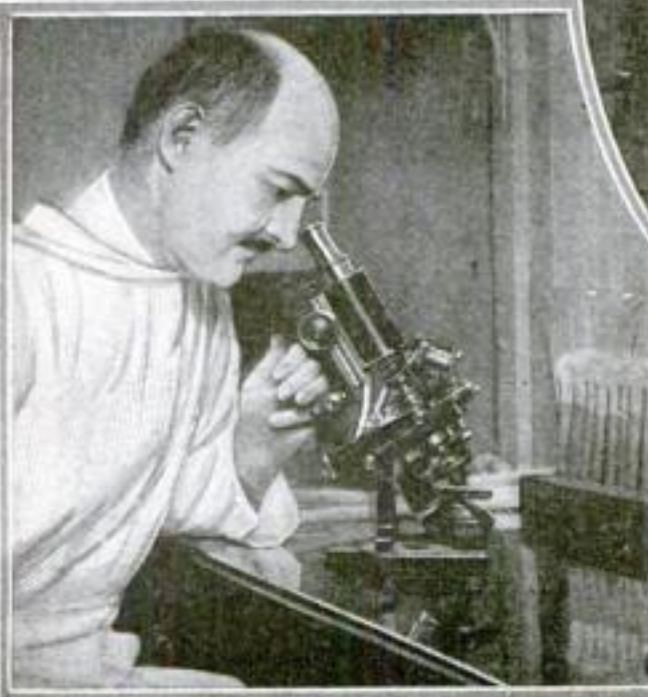
© Keystone

**A TRIO OF MASTER MINDS** in the realm of electricity. From left to right: Dr. Irving Langmuir; Dr. W. R. Whitney; Dr. W. D. Coolidge. Langmuir is the inventor of the gas-filled, or nitrogen electric, lamp, as well as the 20-kilowatt vacuum tube—the tube that was first used at Rocky Point, L. I., for successful transatlantic radio communication. Whitney,

who is director of the Research Laboratory of the General Electric Company, is the holder of many electrical patents. One of his outstanding achievements was the perfection of a submarine detector used during the war. Coolidge recently perfected a 200,000-volt X-ray apparatus, one of the largest made, used as a radium substitute in the treatment of cancer.

**DR. EDWARD FRANCIS**, of the United States Public Health Service (below), after exhaustive investigations since 1919, has discovered the sources of "rabbit fever." The malady presents symptoms similar to those of typhoid or septic infection, and lasts from three to six weeks. Doctor Francis has found that it is transmitted to man from rodents by the bite of an infected blood-sucking insect, or by the handling of infected rodents.

© Keystone



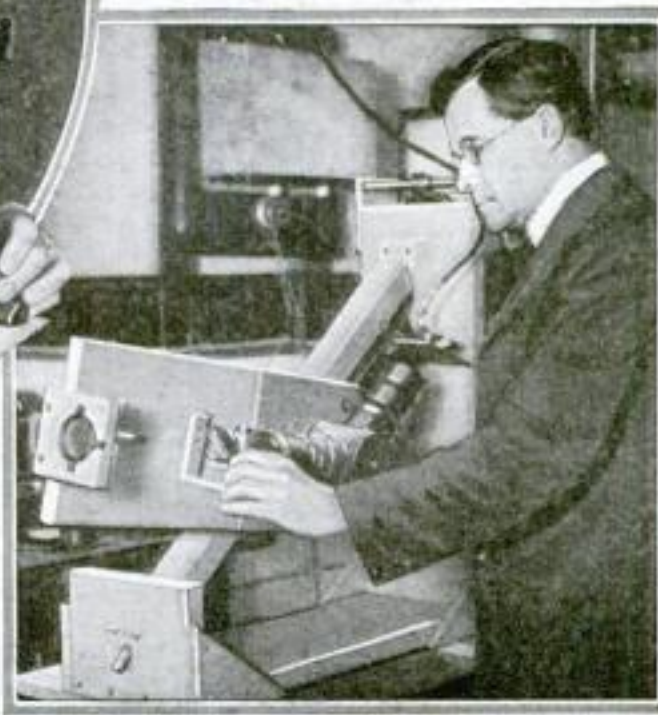
Dr. Edward Francis in his laboratory



© Keystone

**DR. WILLIAM MANN**, of the United States Bureau of Entomology, has just returned from Mexico, bringing new facts about the Mexican fruit fly, one of the pests that cause this country more than a billion dollars damage each year.

**DR. W. W. COBLENTZ**, of the United States Bureau of Standards, announces as the result of laboratory experiments that aluminum paint, if applied to the under side of an automobile top, tent, or awning, will reduce greatly the amount of heat absorbed by the sun and re-radiated on the under side. He has found, too, that the heat radiated from an aluminum painted radiator is measurably less than that emitted by a radiator painted with a non-metallic paint.



Dr. W. W. Coblenz testing heat radiation





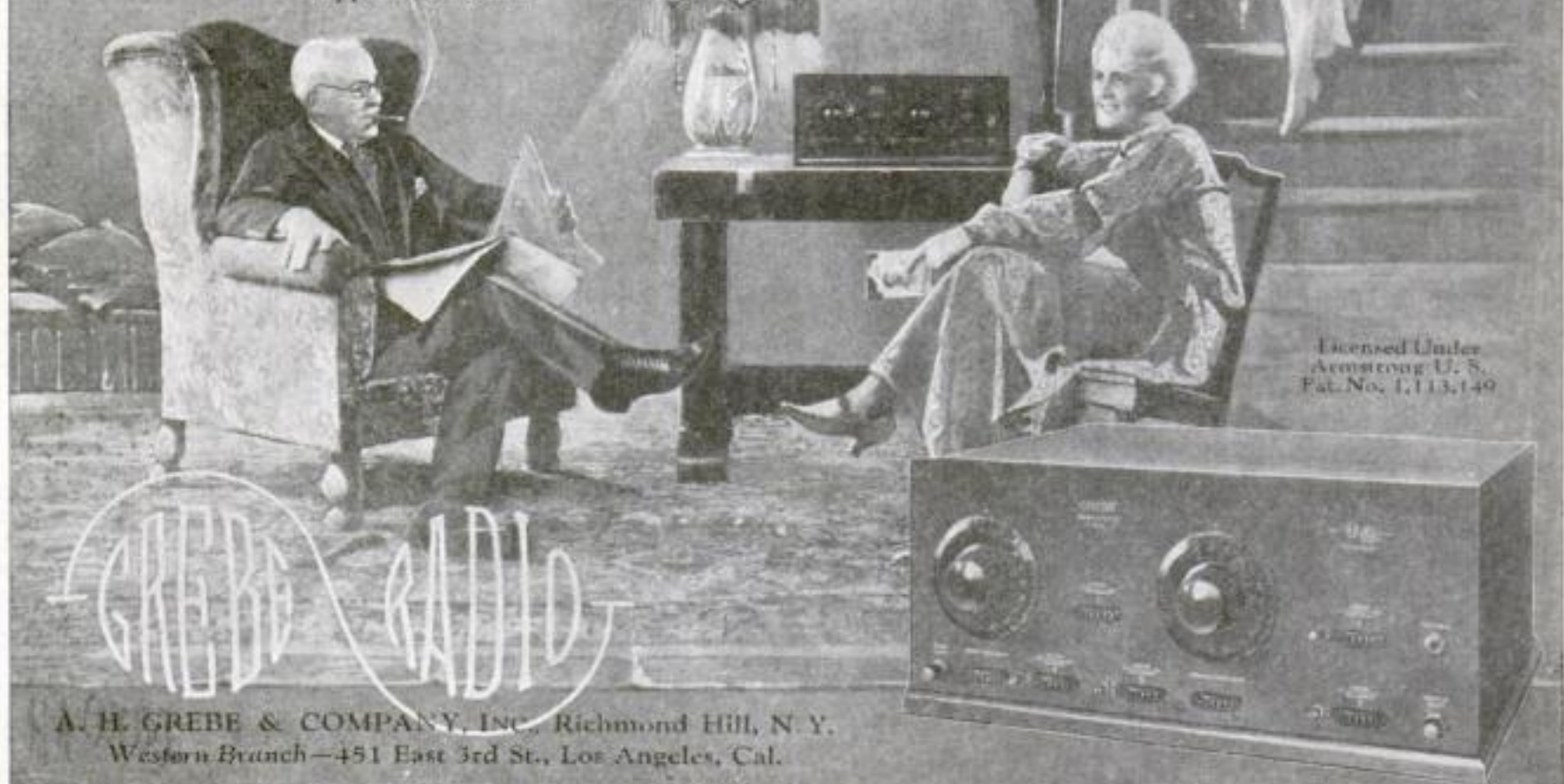
"The Wise are free from  
perplexities."  
Confucius

Perplexity never  
comes to the owner  
of a **GREBE**  
Broadcast Receiver.  
he is truly  
a Wise man  
Doctor My.

**T**HE 20-foot silk-covered wire, supplied with this Receiver, is the only antenna required. You may conceal this wire behind the picture moulding, or run it along the baseboard of your favorite room.

The attractively finished walnut cabinet has compartments for all necessary batteries.

Write for "GREBE  
Radio in the Well-  
appointed Home"



Licensed Under  
Armstrong U. S.  
Pat. No. 1,113,149

**GREBE RADIO**

A. H. GREBE & COMPANY, INC., Richmond Hill, N. Y.  
Western Branch—451 East 3rd St., Los Angeles, Cal.



# "Flightless" Flights Test Aviators



Duplicating with scientific precision the extraordinary atmospheric conditions of the heights to which aviators must be physically fit to fly, the United States Army Air Service is selecting its personnel by flightless "flights." A steel tube within a building incloses a dramatic scene—tense figures in arctic clothing enduring torturingly rarefied air and using oxygen masks to retain consciousness.

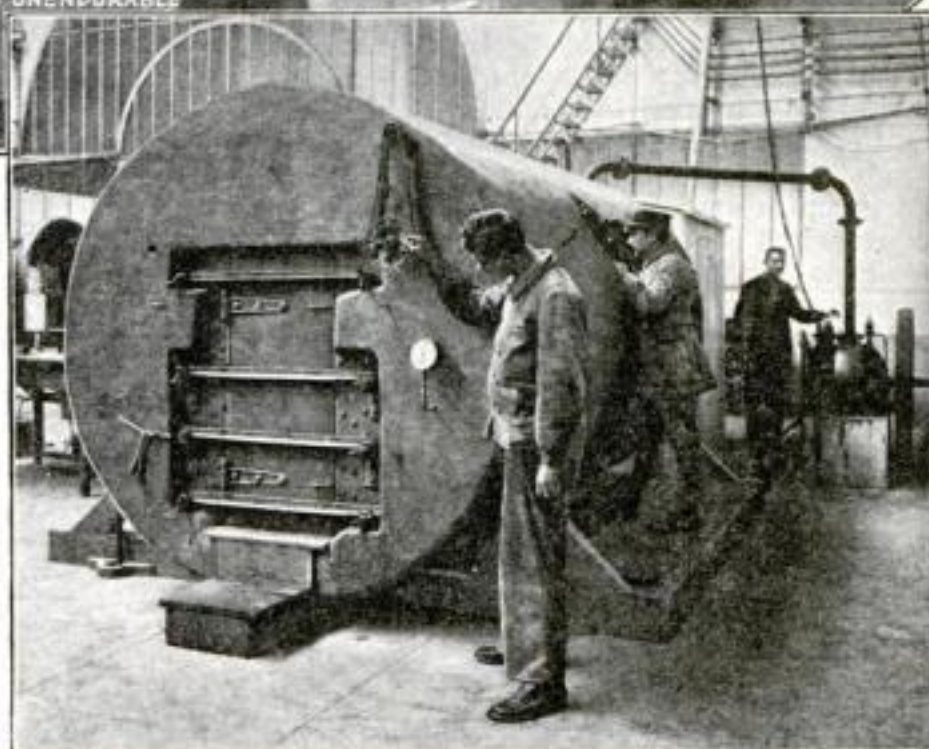
THE prospective military air pilots shown here actually are inside a riveted steel cylinder that rests on the ground, although theoretically they are 25,000 feet above the earth. The meteorological conditions at that great height have been scientifically produced in the tank to test the candidate aviators' physical equipment for flying, before they are permitted to risk themselves or a machine in flight. Twenty-five thousand feet above the ground the temperature is lower than 20 degrees below zero. Refrigerating apparatus lowers the temperature of the tank to that figure. At 25,000 feet the air is so rarefied that pilots must administer oxygen to breathe. So rarefied air is supplied artificially to the tank, and those under test are furnished with oxygen masks for use when the air becomes too thin.

Meanwhile, observers watch through a window the reactions of the recruit flyers to the changes in atmospheric conditions, timing their movements and listening over a

telephone to the remarks they make, which indicate how they are standing the test.

By the use of such tests, military aviation authorities believe they can separate the fit from the unfit among prospective pilots, thereby reducing materially the number of accidents attributed to the inability of airmen to withstand great heights.

The same tank is also used to test experienced pilots who are about to attempt flights for altitude records. From France, where the tanks have been used with much success, recently came a story of a military aviator who was forbidden by his superiors



The exterior of the ingeniously contrived steel tube that creates artificially the terrific exactions of military aviation to test the physical capacity of candidates for the service, thus saving lives, planes, and money. Note observation officer

to essay a record flight because of his evident suffering while undergoing the tank test. Had he attempted the actual flight, it is said, he might have lost control of his machine and plunged to death.

Apparatus similar to the tank here shown and used for a like purpose is at Mitchell Field, L. I., and other military aviation centers in the United States.



# Cheap Motor Fuel from Coal

## Ford's New Distilling Process Promises to Save Vast Sources of Power and Light that Now Go Up in Smoke

By Raymond J. Brown

**I**N TWO power plants, one in Michigan, the other in Canada, Henry Ford has taken what engineers assert is one of the most important and revolutionary steps of the last quarter century in industry.

He has installed apparatus for the distillation of coal at low temperatures for the purpose of extracting certain by-products that heretofore literally have gone up in the smoke from factory chimneys.

To the average man, salvaging the smoke from industrial furnaces would seem to have little bearing on his ordinary life, beyond the possibility of relieving him from breathing smoke-laden atmosphere. And yet the new Ford project concerns the average man even more deeply than it does the industries that it may benefit. For among the promises that it holds forth are these:

### Process Improves Bituminous Coal

Huge quantities of an efficient motor fuel cheaper than gasoline.

Cheap and efficient lubricating oils and greases for the automobile.

Cheap illuminating gas.

Cheap oils for fuel and light.

Cheap oils and chemicals (including ammonia) suitable for a wide variety of domestic and industrial purposes.

Smokeless fuel comparable in efficiency and cleanliness with anthracite coal.

And all of this, mind you, without affecting in any way the utility of the coal in producing light, heat, and power for industrial purposes!

In other words, an industrial plant may distil the bituminous coal ordinarily burned in its furnaces, to extract from it the motor oil and other by-products that would go up in smoke in the ordinary process of burning, sell these by-products to industrial and household consumers, and then burn the remaining coal as usual to operate its engines or dynamos, because the distilled residue has better heating qualities than the original coal.

This is not guesswork. The facts have been scientifically checked in the laboratory by experts in the Ford employ. It is no more an experiment, for within the next few months, it is announced, the new Ford gasoline substitute and the other coal by-products from the two plants will be on the market.

The project may be called an experiment only in that the quantity of motor fuel, lubricating oil, and similar products to come from the two Ford plants will be inconsequential when compared with the total amount consumed in the country. Although entirely new, the process will not be monopolized. It will be offered to any industrial concerns that may care to install it in their plants. And if, as is expected, other large plants distil their coal before consuming it, quantities of motor fuel and



V. Z. Caracristi, one of the engineers who worked out the Ford process of coal distillation. He is shown holding a piece of the smokeless coal from which the valuable by-products indicated below have been removed or "distilled"

similar products, comparable to the present total output of the petroleum wells of America, can be offered to the public at prices that ought to be amazingly low.

The vast quantity of valuable fuel and light products dissipated every day in the

**"THE most profoundly interesting possibility of the economic use of fuel of the present day," is the way Ford's coal distillation project is characterized by a fuel engineer of a great American chemical corporation. Professor Jerome J. Morgan, Ph.D., of Columbia University, an expert on fuel chemistry, adds that "the results certainly will be watched with great interest by engineers."**

smoke of the nation can be appreciated by a consideration of calculations recently offered by consulting engineers of New York City, who assert that the by-products obtainable from a single ton of industrial coal by the process are as follows:

Ten gallons of motor fuel.



Valuable fuel, light, and lubricating products obtainable from a single ton of coal and now wasted in smoke

From 7000 to 8000 cubic feet of effective illuminating gas.

From 2 1/2 to 3 1/2 gallons of creosote oil.

From 1 1/2 to 2 1/2 gallons of lubricating oil.

From 8 to 12 pounds of lubricating grease.

Twenty pounds of sulphate of ammonia.

A greater or less quantity of a heavy oil of tarlike character suitable for use as fuel.

When it is considered that the annual production of bituminous coal in the United States has averaged almost 500,000,000 tons a year for the last 10 years, it is apparent that the general adoption of the distilling process would make available to the public vast amounts of oils and gas.

In point of interest to the motorist alone, the distillation of 500,000,000 tons of coal, according to these figures, would supply every motor car in the United States with sufficient fuel to run it almost 8000 miles. This is probably greater than the average mileage of most automobiles for a year.

### To Distil 4400 Tons Daily

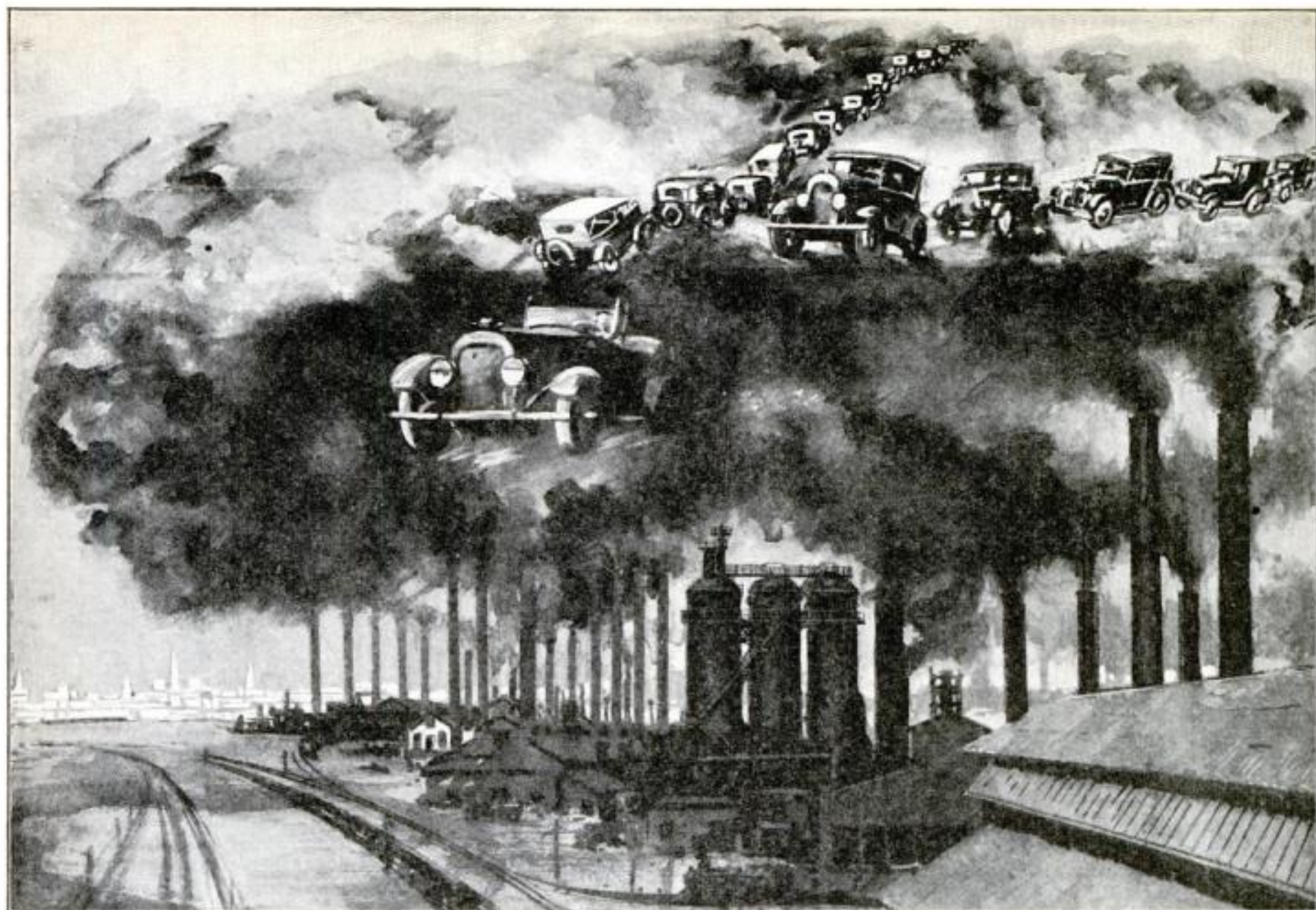
The Ford plants where the coal distillation is to be carried on now are under construction at River Rouge, near Detroit, Mich., and at Walkerville, Ont., Canada. The Michigan plant will distil the 4000 tons of coal it expects to consume daily in its operation. The Canadian plant will distil 400 tons a day. Both will be in operation within a few months. In connection with the amount of coal that these plants will use, it is probably well to note that engineers who have investigated the new process of coal distillation report that it probably would be unsuitable for use in places where normal coal consumption is less than 400 tons a day.

The distillation of coal is no new process. It has been practised for years in the production of illuminating gas and coke, in which high temperatures—about 2500 degrees—always were employed. Always when attempts were made to distil at low temperatures, coals and tars were found to stick to the mechanism of the furnaces and retorts, interrupting the operation—a difficulty, by the way, that was not entirely unknown in high-temperature distillation. In high-temperature distillation, too, the excessive heat was inclined to bring about chemical reactions in some of the products while they were in the gaseous state, altering their chemical constituency and making them useless. Maintenance of the high temperatures also was expensive.

So, although chemists long have believed that a low-temperature distillation process would result in the extraction of important substances from coal, until the Ford experiments began, no low-temperature process had been devised. The chief products of coal distillation remained illuminating gas and coke.

The Ford method was worked out by V. Z. Caracristi and Emil Piron, New York engineers. The basic idea of their system





Wasted smoke from America's coal supply represents potential motor fuel sufficient to drive every car in the United States for a year, according to chemical engineers working on the problem

is highly ingenious, yet extremely simple. Molten lead is employed to transfer the heat for distillation. A great pool of this metal, heated to 1100 degrees, lies in a huge furnace. Over its surface is carried an endless conveyor of iron plates or pans, hinged together. Since these pans are of lower specific gravity than the lead, they float on the pool as wood floats on water. On them powdered coal is spread about half an inch thick.

As the pans float through the oven, they are heated more rapidly than would be possible were the heat from flames to pass to them through the air, because lead conducts heat 80 times faster than air. The heat of the pans, of course, is transmitted to the coal they carry, and the coal breaks into its gaseous constituents. These gases are gathered, cleaned, and separated for further treatment. After the pans pass out of the furnace, the residue is removed from them.

### How Smokeless Coal Is Burned

The residue is a coal agglomerate similar to coke, and giving no smoke. It can be converted into briquettes of an anthracite character for domestic or industrial use, burned in powdered form in special furnaces, or ground and mixed with high volatile coal to make metallurgical coke.

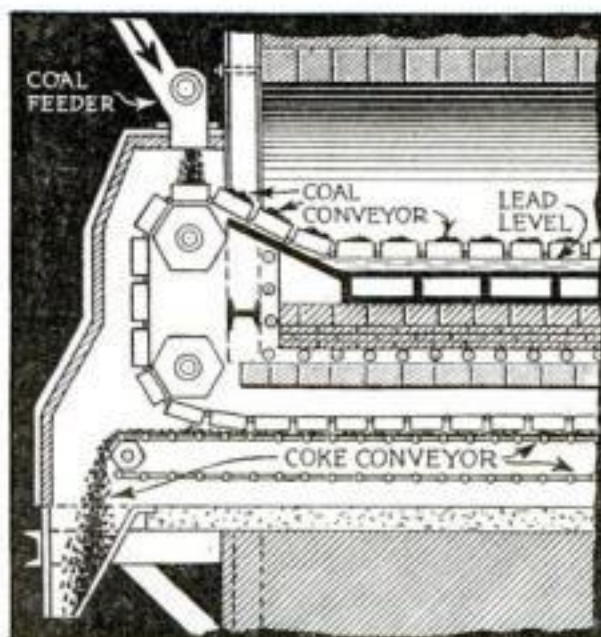
This apparatus is said to be not only simpler than the furnaces and retorts commonly employed in the distillation of coal, but less expensive in installation and operation.

Mr. Caracristi recently called the Ford process a "flank attack on some of the elements contributing to the high cost of power and gas and to the cost of fuel for

domestic purposes, at the same time providing a source of supply of light oil to meet motor fuel requirements."

Places where engineers say the process may be employed effectively include mines, power stations, gas plants, factories, railroads, and distilling plants where sawdust and other forms of wood are used for the production of wood alcohol, acetic acid, and pitch. The railroads first would distil their coal, then use the anthracite-like residue to run their locomotives.

Industrial concerns using coal in large quantities are observing the Ford project



How the coal-distilling furnace operates. Powdered coal is carried in conveyor pans moving over a pool of molten lead. The intense heat breaks the coal into its gaseous constituents, which are gathered and transformed into by-products. The smokeless, coke-like coal, a high grade commercial fuel, is carried off by a second conveyor

with eager interest. They recognize its economic value provided the by-products have a market value greater than the cost of installing and operating apparatus for their extraction—a requirement that must be demonstrated before the general adoption of the Ford process may be hoped for.

By distilling coal before burning it for industrial purposes, a saving of not less than two dollars a ton will be effected, say the engineers who have designed and installed the distilling apparatus. That is to say, the motor fuel, lubricants, and other by-products extracted by distillation can be sold at prices that will cut not less than that amount from each ton of coal normally consumed. They add that in factories and other plants using large quantities of coal, the saving resulting from distillation will be sufficient to defray in a short time the cost of installing the special furnaces which the process requires.

### Engineers Confident of Profit

Six months, or at most a year, the Ford engineers assert, will be required to demonstrate that low-temperature coal distillation can be conducted cheaply enough to bring a profit. Their experiments at the Ford coal mines in West Virginia, they say, already have proved this fact to their satisfaction. They have expressed themselves as certain that the practical operation of the plants in Michigan and Canada will prove it to the rest of the industrial world.

They are making no promises and few predictions, but many who have given close study to the various aspects of the Ford plan profess to see in it future possibilities of immense interest to the average man and his pocketbook—including a realization of the motorist's dream of ten-cent gasoline.





Sleeping student aviators learning to receive high speed code messages at the Naval Air Station, Pensacola, Fla. Chief Radioman J. N. Phinney, discoverer of this remarkable method, and author of the following article, is shown standing at the extreme left

# How to Learn Radio while You Sleep

By J. N. Phinney

Chief Radioman, United States Navy

**I**F YOU wish to become an expert radio operator or land telegrapher quickly, learn while you sleep.

Go to bed with your head phones over your ears or within sound of a clattering telegraph instrument, and in an almost unbelievably short time you will be able to receive code messages at a speed that will amaze you.

That is the way I learned telegraphy as a boy. That is the way the Bureau of Aeronautics of the United States Navy now is teaching radio transmission and reception to student aviators. The method is past the experimental stage. It may be said to have become a standard system of instruction, since I demonstrated recently its practical value at the naval air station at Pensacola, Fla.

Eminent psychologists have given an explanation of the brain's strange faculty of absorbing and retaining information during sleep. The subconscious mind, they say, continues to function while the body and the conscious mind lie dormant.

Without attempting to explain the phenomenon from the psychological standpoint, I can speak authoritatively with regard to the way in which the "learn while you sleep" method worked out in my own case. I can describe, too, our experiments at Pensacola, which are borne out by Navy Department reports and by the written statements of the students who benefitted by the experiments.

At the age of 17 I landed my first job as a railroad telegrapher, handling a night trick on a slow line. Slow as the line was, however, I was slower still, and I soon was forced to the conclusion that, unless I increased my speed at once in some miraculous manner, I was likely to find myself out of a job. I slept beside the main line relay, which was always clattering away much faster than I could copy. In a surprisingly short time I found myself able to read the fastest operator on the line. The miracle had occurred. Somehow I had learned while I slept.

Years later—in 1914—when I was radio operator at the naval radio station, Jupiter Inlet, Fla., I found myself obliged to receive messages from a crack operator in Jacksonville whose speed was much too great for me. I decided to make an experiment. For several nights I slept be-

side an electrically driven automatic sending device. At the end of that time I found myself able to take all the Jacksonville operator shot at me and ask for more.

That decided me. If I could learn radio and telegraph codes during sleep, why couldn't I learn other subjects in the same way?

To investigate, I set up many sorts of automatic dictating devices at my bedside and at the bed-sides of others. The results of these experiments convinced me that I had fallen upon a method of teaching telegraphy that was quick, easy, and certain.

My first opportunity to try it out came a short time ago when 12 naval medical officers started

our flight course. One, a noted specialist in psychology, expressed a desire to try my method. A single night with radio messages throbbing in his ears as he slept enabled him to copy radio with much greater ease, accuracy, and speed than ever before, and the result of his report gained me the coveted opportunity to conduct further experiments with official sanction.

Tests with enlisted men were carried out among students who were so backward about learning radio that failure appeared certain. Seventeen volunteered for a test. The following results were noted the next day:

One of the 17 copied five words a minute faster than before.

Four copied three words a minute faster and one nearly three words faster.

Four copied two words faster, and one nearly two words faster.

Three copied one word faster and one half a word faster.

Two slept on the floor and caught a cold and headache respectively.

Six subsequent tests have been made on these students, with the result that radio has lost its terror

for them and they have averaged

a gain of three words a minute each night in receiving ability.

The instructors derive some amusement to compensate them for their loss of time and sleep by watching the facial contortions, restlessness, and mutterings of the students under test. Errors and uneven sending cause restlessness and muttered protests.

We are using the new system at Pensacola not only as a life line for those who are about to be dropped from the class, but to give those who seem to need it a chance to enjoy its benefits early in the course.

Since the "learn while you sleep" system has so fully proved its value, we have replaced the hard wooden benches and tables of experimental days with the regular army cot for the radio students. It has been established that the men learn just as rapidly when sleeping in comfort as in discomfort.

## Try This Way of Teaching Yourself

**R**ADIO fans throughout the country were amazed recently by an announcement from the Bureau of Aeronautics, United States Navy Department, that student aviators at the naval air station, Pensacola, Fla., were being trained to receive radio code messages at high speed while they were asleep.

In the accompanying article Chief Radioman J. N. Phinney, who is in charge of the radio school at the air station, tells how he discovered this seemingly miraculous method of learning. He explains how he uses the subconscious mind's strange faculty of absorbing and retaining information during sleep as the basis of a remarkably successful system of instruction. He shows how you can employ this system in learning, not only radio, but other subjects that require the exercise of memory and quick thinking.

Try this method on yourself. Put on the head phones when you go to bed. See how much you can learn while you sleep.

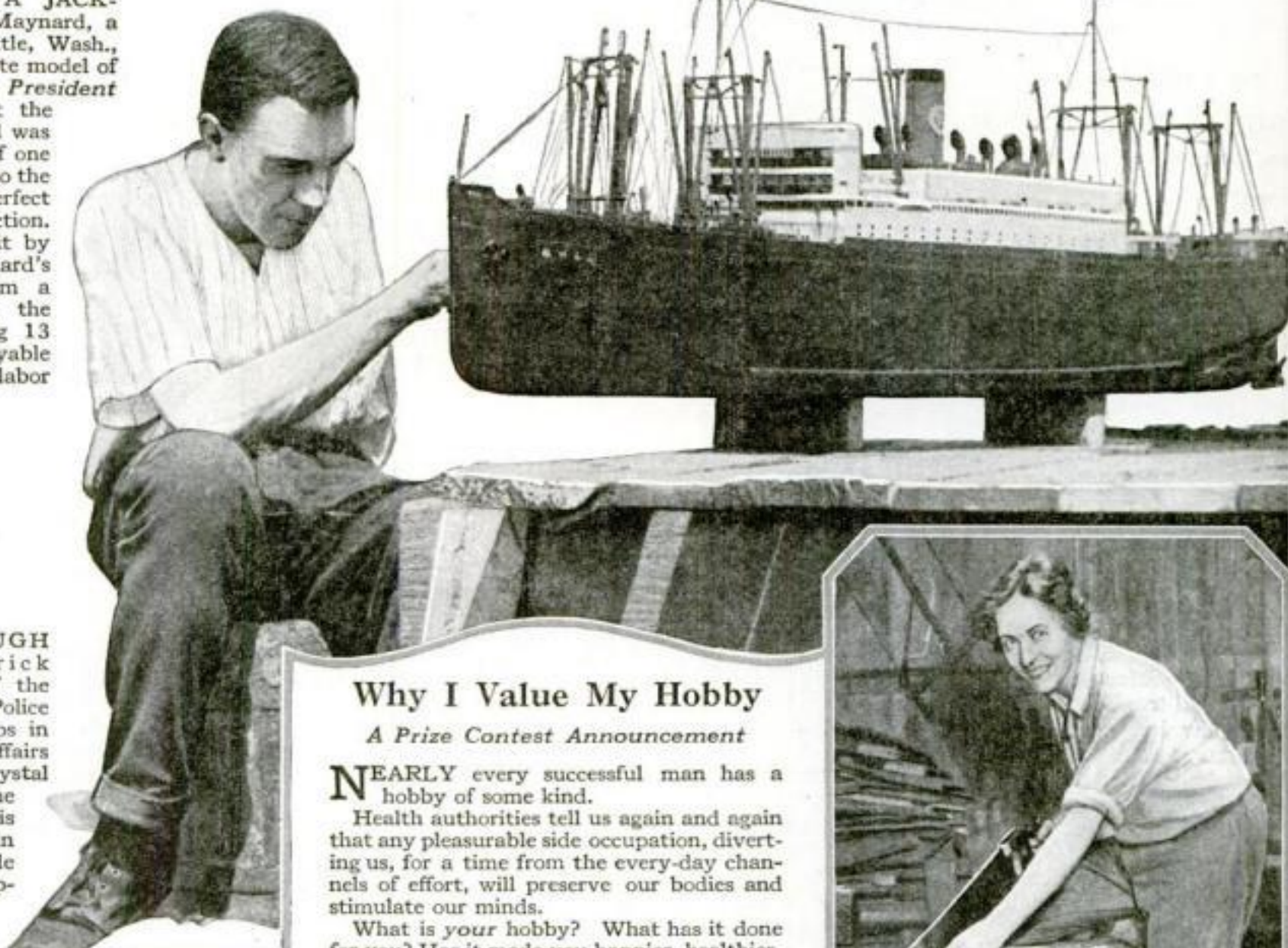




# They Find Happiness in Hobbies

And Health in Useful Relaxation from Business or Profession

USING ONLY A JACK-KNIFE, L. A. Maynard, a mechanic of Seattle, Wash., carved an elaborate model of the Oriental liner *President Grant*, shown at the right. The model was built on a scale of one eighth of an inch to the foot, and is a perfect detailed reproduction. It was carved, bit by bit, during Maynard's spare hours, from a block of cedar, the work requiring 13 months of enjoyable and healthful labor



HAPPY THOUGH BLIND, Patrick O'Keefe, hero of the New York City Police Department, keeps in touch with world affairs by means of a crystal radio set which he built himself. He is shown listening-in with his homemade radio receiving apparatus

## Why I Value My Hobby

*A Prize Contest Announcement*

**N**EARLY every successful man has a hobby of some kind.

Health authorities tell us again and again that any pleasurable side occupation, diverting us, for a time from the every-day channels of effort, will preserve our bodies and stimulate our minds.

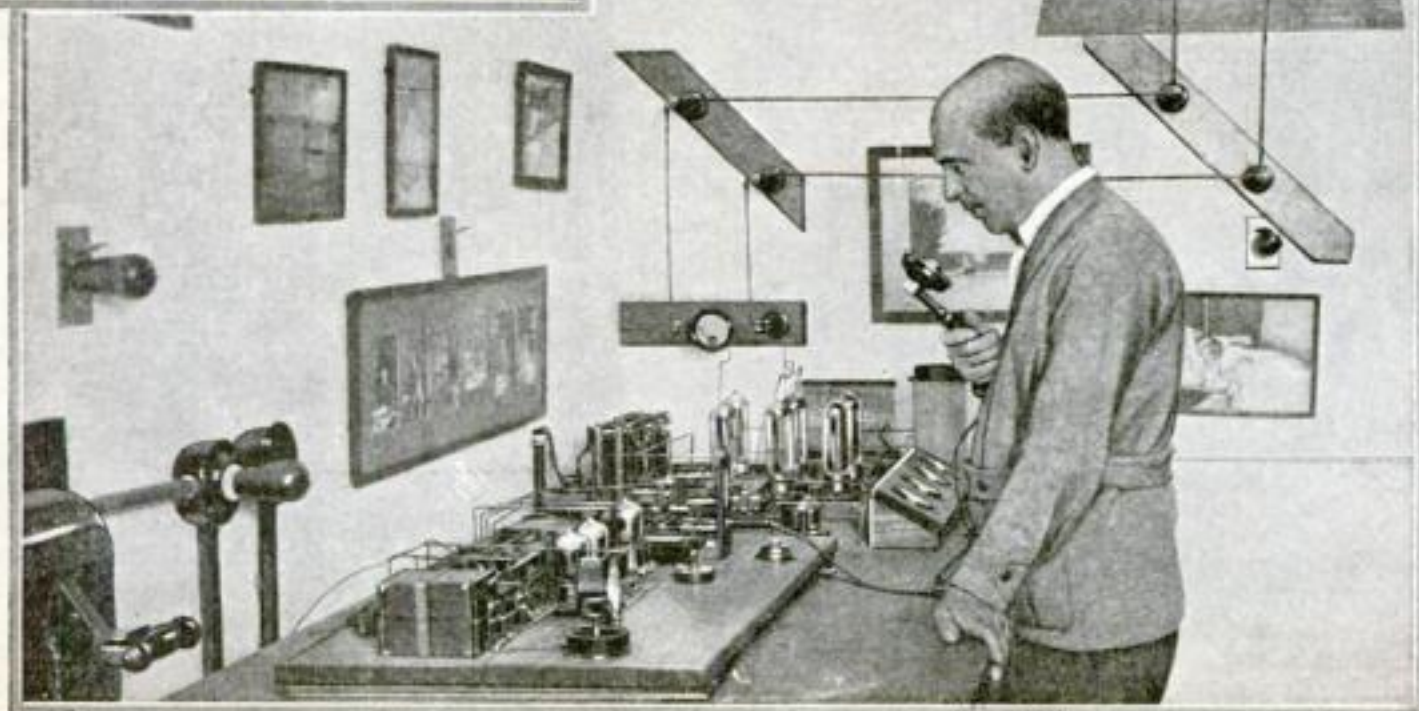
What is *your* hobby? What has it done for you? Has it made you happier, healthier, more successful? And how?

Write and tell us about it. For the best letter of not more than 400 words, accompanied by a photograph of yourself at your hobby, we offer \$20, first prize; \$10, second prize; \$5, third prize.

Address letters to Contest Editor, Popular Science Monthly, 225 West 39th Street, New York City. Each letter will be considered by a board of editors whose decision will be final. Competition closes November 20, 1923. Winning contributions will be published in the March, 1924, issue.



**CABINETMAKING** is the hobby of Miss Dorothy Moore, New York art student, who in her spare hours has trained herself to be an expert carpenter. She has specialized in working on unusually fine pieces of antique furniture, repairing broken parts, and building in new ones



**RADIO DE LUXE** is the pastime of Charles Erbshtein, noted criminal lawyer of Chicago, who at his home four miles east of Elgin, Ill., operates one of the finest privately owned radio broadcasting stations in America. He is shown at the left talking into the microphone at his own station, WTAS



# My Doctor Is under Contract to Keep Me Well

## Why It Pays Me to Employ a Health Manager

*An Interview with*  
**Samuel M. Vauclain**

Pres., Baldwin Locomotive Works

**U**NTIL 1918, when I was 62 years old, I had been able to better the boast of those persons who assert that they never have been sick a day in their lives. I never had been sick for so long as a minute. In fact, even the possibility that I might ever become sick never had occurred to me.

My attitude toward my physical condition, in short, was that of the average person who is blessed with strength and abundant health.

And then I contracted influenza. The experience of lying in bed, forced to rely on others for the services I always had been able to perform for myself, annoyed and troubled me. During my convalescence I did a lot of thinking.

Why had I become sick? Could I have prevented it? Was I likely to become sick again? How might I avoid it?

These were the questions I asked myself, over and over again. Finally I reached a decision.

"Doctor," I said to my physician one day when he called, "I've been sick, and I haven't liked it. I don't want it to happen again—if it's possible to prevent it. Is it possible?"

"I believe it is," he said after a moment's hesitation.

"Very well, then," I said. "I'll make a contract with you. Keep me well for 10 years, and I'll pay you a flat sum every year, the amount to be increased each year on the assumption that, the older I grow, the more difficult it will be for you to keep me well.

"On my side, if you will try to keep me well, I will agree to do everything you say, submit to as many examinations as you wish, follow any diet you prescribe, work as many hours as you say, refrain from work when you advise—I'll put myself entirely in your hands for 10 years. But you must keep me well. If I fall sick, you must pay a penalty. I shall make deductions from your annual retainer according to the length of time I am sick. I don't expect you to achieve the impossible, however. Should I suffer any serious, incurable illness, which you could not have prevented, the contract is to be

### Kansas Town Hires Doctor

**C**ONVINCING proof that Mr. Vauclain's unusual health contract plan, described in the accompanying article, is entirely workable not only for individuals and family units, but even for entire communities, is offered by Sharon, Kansas, a town that once had no physicians. Here the announcement by a prominent family that it would have to move to another town where medical attention would be available caused Sharon residents to co-operate in devising a plan to obtain a community doctor of their own.

They formed an association of about 1000 farmers and townspeople, brought a doctor to Sharon, and signed an agreement with him. Each member now pays \$15 a year for medical services for his family. Not only has the plan cut down doctors' bills, but it has decreased remarkably the disease and death rates in the community.

cancelled. Will you enter into such an agreement with me?"

"A real contract?" he inquired.

"A real contract," I declared, "in legal form, binding and actionable at law."

He thought for a moment. Then he nodded briskly, signifying his acceptance.

Five years have passed since that contract was made. I have kept my part of it, and my doctor has kept his. Except once or twice when it was necessary for me to make long journeys, I have been examined not less than every two weeks, and have guided myself entirely by the doctor's instructions. In that time I have not lost a day from business, nor have I been ill in any way. I am heavier, stronger, and

more active than I was five years ago, and my capacity for work seems to be greater.

Being under a doctor's care has been in no sense a hardship. The doctor has warned me against excess with regard to certain foods, but he has not placed me on a diet. He has not forbidden me to smoke nor has he insisted that I retire at any unusually early hour. I am merely leading a normal, healthful life, suitable to a man of my years, with a competent physician to guide and advise me.

What I am doing may be unusual, but I consider it sensible and logical. It is nothing more than utilizing in the care of my body the same principles that I have been using for years in the care of my business. No one would think of attempting to conduct a business enterprise without a capable manager. Why not, then, a capable manager for your body?

The human machine, like any other machine, will wear out.

It demands attention and repairs. After you buy an automobile, you must inspect and repair it frequently if you expect to keep it running efficiently. The sensible man in business does not wait until he is in trouble, then rush away in search of a lawyer to get him out of it.

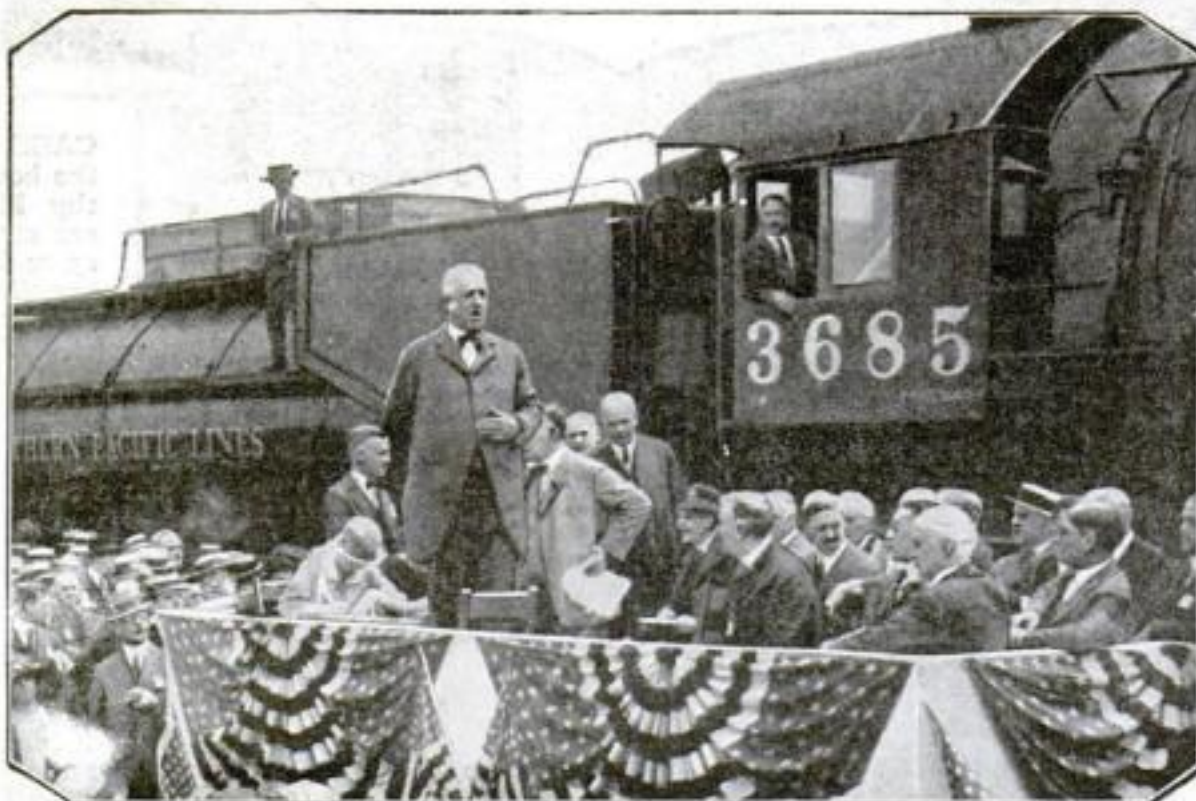
Why, then, should people wait until there is serious bodily trouble before they call for a physician? Is their health of less value to them than their automobile, or their business?

From my own experience of the last five years I should say that the family physician should be placed on a basis entirely different from his present one. He should be consulted before illness.

I can imagine no happier arrangement than one that would place, say, 25 or 30 families under the care of a physician to whom each of them would pay an annual fee in return for systematic and regular medical attention. The physician would visit each family once a month. He would examine its members, prescribe for them if necessary, and advise them how to preserve their health, in short, keep his patients well.

Physicians would be able to perform this service for a reasonable fee, for it would not interfere with the other demands of their practice.

Such a system, universally adopted,



Vigorous and powerful at the age of 67, Mr. Vauclain is shown here speaking at ceremonies attending a recent shipment of 20 great oil-burning locomotives from the Baldwin Locomotive Works at Eddystone, Pa., to a railroad in Texas





**S**AMUEL M. VAUCLAIN, president of the Baldwin Locomotive Works, is a living proof of his contention that assurance of good health and success in work go hand in hand. Since his birth at Port Richmond, Philadelphia, 67 years ago, his career has been a steady march upward. He started work, at 16, in the Pennsylvania Railroad shop at Altoona. Thirteen years later he became superintendent of equipment for Burnham, Williams & Co., Philadelphia, proprietors of what now is the Baldwin Locomo-

tive Works. The next year he became general superintendent; a member of the firm in 1895; vice-president in 1909; senior vice-president in 1917, and president in 1919.

Vauclain is credited with being responsible, more than any one, for the modern compound cylinder locomotive. In proof of his genius, the Eddystone plant of the Baldwin Locomotive Works this fall smashed all records for production, turning out 31 locomotives weighing from 350,000 to 400,000 pounds each in 31 hours, or one every hour

would pay enormous dividends in health and happiness.

Every one suffers physically and financially during illness. The majority of men who earn their bread with their hands are not paid at all when they fail to report for

work, whether their absence is due to illness or other causes.

And so I say, go to your physician and let him examine you. If you are well, it will be cheering for you to hear him say so. If you are not well, he will tell you how you

can become so. Follow his advice and make your visits to him frequent. This is health insurance of a practical sort. The premium rate is small; the value of the policy enormous—the safeguarding of your own life, health, peace of mind, and efficiency.

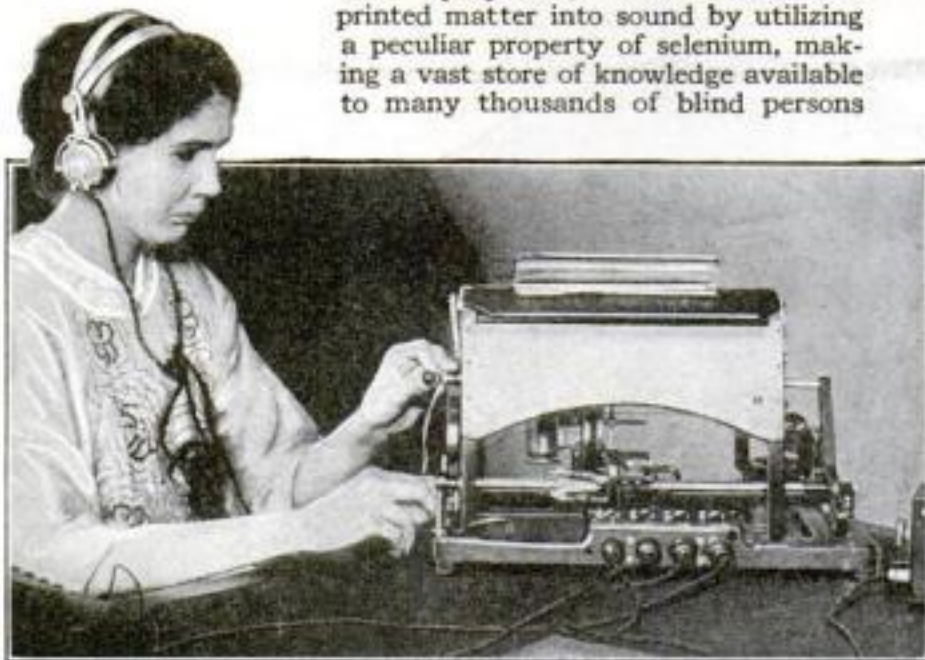


# Printing Made Audible for the Blind

A CLEVER invention that transforms printed or typewritten matter into sound is science's latest offering to the blind. Once the blind operator has learned facility in the use of this device, it is claimed, he can read with several times the speed possible to the reader of raised writing, the famous Braille method, now in universal use among blind students. Moreover, the blind "reader" is given access to a vast amount of printed matter which never would be put into raised writing.

This transmutation of printed matter to sound is accomplished by virtue of the remarkable sensitivity of the element selenium to light. This element offers varied resistances to electricity, these being determined by the strength of the light to which it is exposed. It is this property that finds employment in selenium cells.

The "optophone," which transmutes printed matter into sound by utilizing a peculiar property of selenium, making a vast store of knowledge available to many thousands of blind persons



In the "optophone," a selenium bridge is exposed to successions of light pulsations, which vary according to the forms of the letters in the printed line. These variations are made electrical by the varying electrical resistance of the selenium. These electrical variations are transmitted as sounds to the blind "reader" through a telephone headpiece.

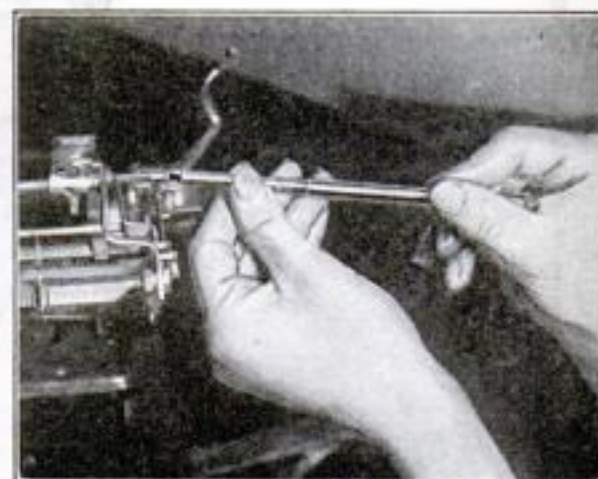
A characteristic sound is produced by each letter and symbol, so that a sound alphabet, said to be easily learned, results.



## An Easily Adjusted Wrench for Odd Corners

ONE jaw of this quickly adjustable wrench is rigid, while the other is movable and supplied with teeth, which are engaged by a lever pivoted in the handle when the desired adjustment has been made. It is useful for working in odd corners.

## Stubborn Screws Mastered by This New Driver



HAVE you ever, with mounting rage, picked up for the sixth time a screw that you were trying to insert, and could not, because your hand could not reach the inaccessible spot where it should go in? Or perhaps you were on a stepladder and needed one hand for support.

The ingenious screwdriver here illustrated would have spared your feelings. A pressure of the handle projects two spring clips that hold the screw tightly until it is safely started. Releasing the pressure withdraws the clips and the screw can then be driven in in the usual way.

## The Milk Bottle Is Tamed

THIS recently patented cap remover promises to tame the squirting milk bottle, to banish along with the other woes of yesteryear the staining dribbles of greasy white that attacked you when you were in a particular hurry.

Pressure on the arm of the invention causes a barb to pierce the cardboard. A gentle upward lift then takes the cap from the bottle. Pressing a small spring releases the milk-bottle cap from the barb.

The device replaces the cap as handily as it accomplishes the removal, an added advantage, for it is in this replacing that the worst disaster often lurks.



## Garage Opened while Sitting in Your Car

JUMPING out from behind the wheel to open the garage doors when ready to run the car in for the night has frayed the temper of many a motorist after an otherwise pleasant day's trip. Now a man in Portland, Ore., has devised a method of opening the garage merely by pushing a knob while remaining in the car.

From the house runs a water pipe to an

underground tank beside the garage. From this tank a pipe connects with a cylinder and piston hung horizontally along the length of the garage at the height of the door. A knob, set in a post at a height convenient to the driver's seat, controls the flow of water into the tank.

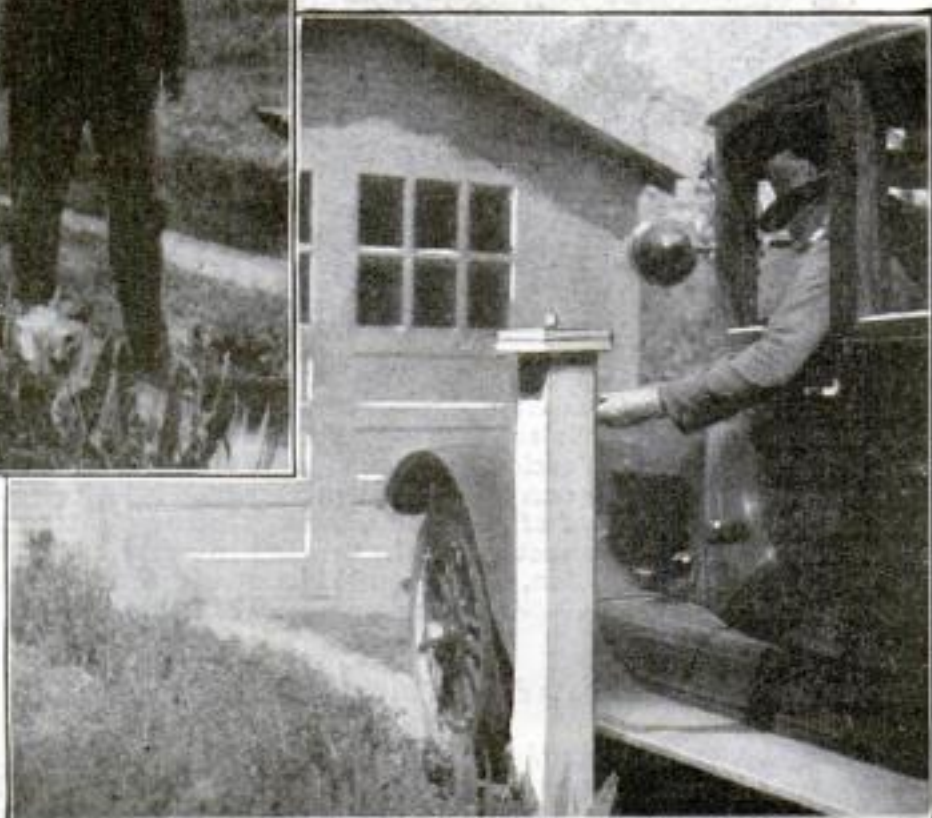
When the tank is filled, the air it contained is forced through the connecting pipe into the cylinder. The piston is driven by the pressure of air, operating two metal arms that throw the garage doors open.

As long as the water pressure is maintained in the tank, the doors remain open. A weight attached to a pulley pulls them closed when the water pressure is released, for the air, rushing back from the cylinder, causes the tank to be drained.

An automatic lock holds the doors closed until they are opened by the apparatus.



The post, with a knob controlling the water content of a tank. When full, the tank forces air into a cylinder, opening the garage doors



Turning this handily located knob opens the garage doors





## A Punch Check Protector Weighing Eight Ounces

**T**HIS handy check protector can be carried in your suitcase, or even in your pocket.

It weighs about eight ounces. The device operates much as does a conductor's punch, the inked characters being forced into the fiber of the paper. The correct position of an impression is assured by a simple gage. The feed is automatic.

## Small Hand Vacuum Pump Has Many Utilities

**A** HAND vacuum pump with a gage for use where the container to be exhausted is small, is a recent device offered doctors, dentists, chemists, and laboratory experimenters, to meet the now widespread need for a handy, quick means of creating vacuums.



A rubber cork that fits a standard bottle tightly is attached to the pump, so that operation of the plunger creates a vacuum in the bottle. The suction hose is attached at the side of the pump, near the cork, the liquid or other matter passing into the bottle and not into the pump or gage. It is said to lift liquids 25 feet.

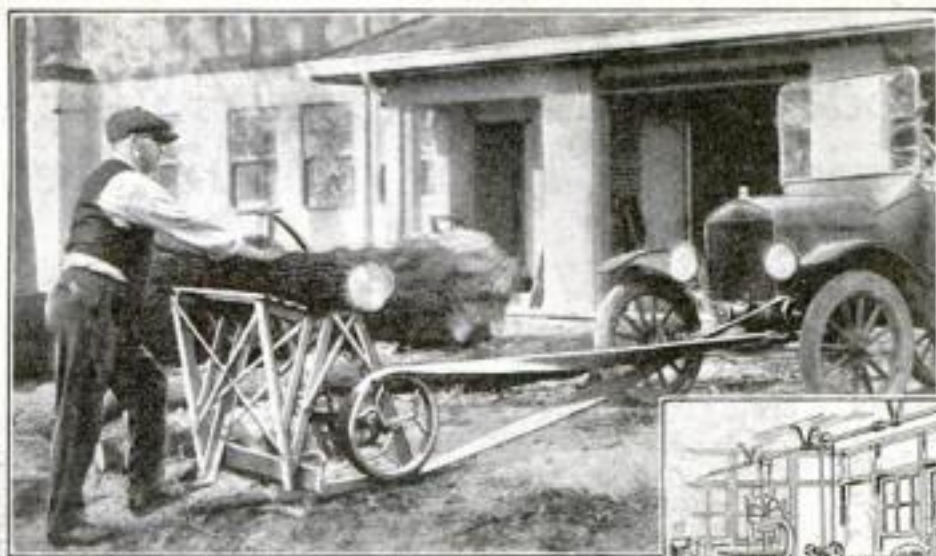
Besides its utility to those mentioned above, the device should prove useful to draw liquids from steam traps, the base of motor boat engines, etc.

## Stationery for the Blind

**B**LIND persons may write letters now without lines that straggle up and down the sheet. The idea that makes this possible, that of perforating lines on stationery with an unthreaded sewing machine, was conceived by Mrs. E. F. Coyle, of Bartow, Fla., who used it first to help a blind relative.

The lines are made amply wide apart. The writer follows the line with the forefinger of the left hand. If the little finger of the right hand is allowed to rest on the paper, the writer will know when the edge is reached.

# Making a Power Plant of Your Ford



Left: The power pulley and a Ford sawing logs. Below: Sketch showing how the pulley enables an auto engine to run a small workshop



**A** POWER pulley that makes a mobile power plant, adaptable to home, workshop, or farm needs, out of a Ford is the latest achieved success of inventive genius in making your automobile a more accomplished mechanism.

The simplicity claimed for the invention is striking. No jacking up of the car or changing of wheels is required. The device is attached to the car near the starting crank, by any one and within a few minutes. It is fairly small and unobtrusive looking, so that it need not be detached when not in use. To put the invention to work, one slips the belt over the pulleys, backs the car to tighten the belt, and starts

the engine. Speed is automatically controlled by a variable speed governor that controls the gas feed. A considerable resultant gasoline saving and the prevention of engine racing are claimed for this governor. A clutch throws the power off and on, so that stopping and starting the engine is unnecessary.

Those who have observed automobile engines when they are developing maximum power will realize that this invention enables a Ford engine to run a small workshop.



## Mud-Spattered Pedestrians Befriended by Inventor

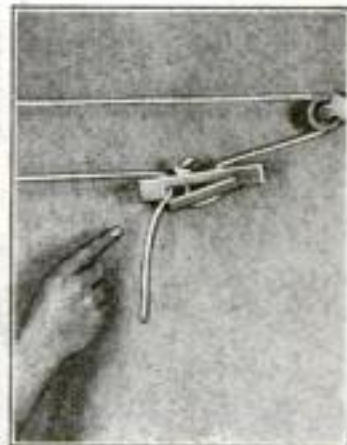
**M**OTOR-CAR wheels are said not to splash mud on pedestrians when equipped with the brush here illustrated.

The photograph is from Paris, where a thoroughgoing series of experiments recently was conducted to determine the most effective means of splash prevention.

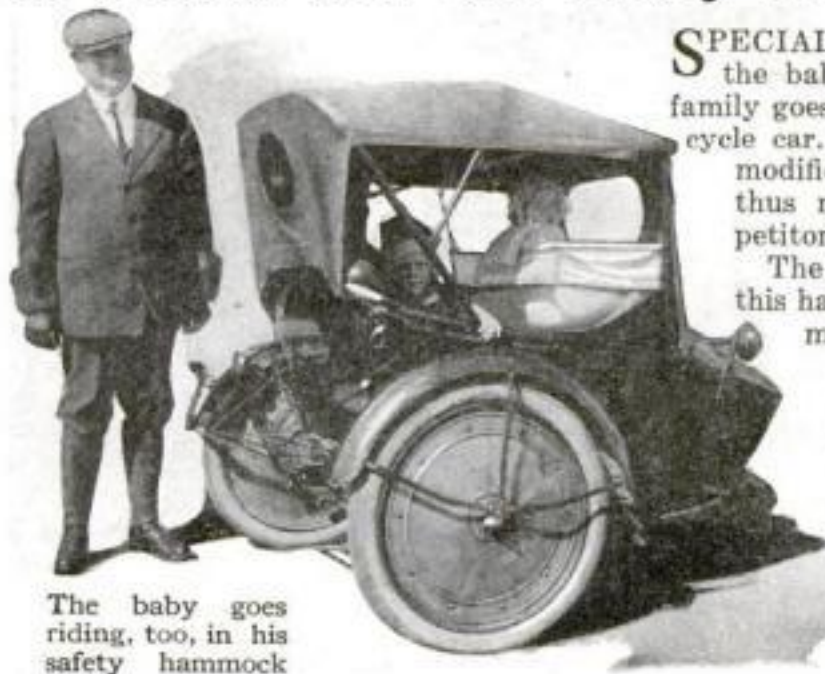
## Your Clotheslines Need Not Be Slack Now

**S**LACK clotheslines can be avoided by use of this rope-joining clamp.

It consists of two pieces of hard wood, one recessed and receiving a short strip in the recessed portion. Two holes are in each block, aligned so that the rope may be threaded through one hole in each and back through the other hole in each. A third hole is close to the end of the recessed portion of the larger block and the rope end extending through it is engaged by the smaller clamping block.



## A Berth for the Baby in a Motorcycle



The baby goes riding, too, in his safety hammock

**S**PECIAL sleeping accommodations for the baby are now possible when the family goes out for a Sunday in its motorcycle car. These useful three-wheeled modifications of the trailer idea are thus made still more effective competitors of the small family car.

The inventive dad who figured out this hammock saw to it that baby was made as comfortable as soft places and shelter from shocks could make him. The movements of the car, as conveyed to the hammock, are converted into an easy, pleasant motion.

The inventor says that his baby never succeeded in getting out, adding that if his baby cannot, no baby can.



# Science—a Modern Sherlock Holmes

## Exploits of Today's Police Detectives Surpass the Imagined Feats of Fiction in Tracing and Preventing Crime

By Richard E. Enright

Police Commissioner of New York City

**R**ECENTLY the scientific detective, who previously existed only in books and on the stage, has become a real and potent figure in the endless war between the police and the criminal. More and more American police are employing science in the detection of crime, surpassing the imaginary exploits of Dupin and Sherlock Holmes, because when Poe and Doyle created their fictional heroes the extraordinary tools with which modern science today arms the law did not exist. Radio, the airplane, even the automobile, were unheard of, and hundreds of practical developments in psychology, physiology, chemistry, toxicology, and the other sciences which the police now use, either themselves or through experts, had not yet been achieved.

When a woman murderer escaped from a California prison a few months ago, she used a swift motor car and an airplane in her flight across the Mexican border. But the police called upon the possibilities of modern science far more prodigally in pursuing her.



Fred Sandberg, of the Washington, D. C., Police Department, said to be the greatest finger print expert in America, reading the story of a print through a magnifying glass

the chemist. The automobile, the motor boat, and later the airplane, are used by the burglar, the bandit, and the drug runner.

It has been only by keeping several steps ahead of the criminal in the employment of scientific weapons that the police have been able to cope with him.

Nowadays the detection of crime has become an exact science, founded on very definite principles. Like all other sciences,

it promptly applies new developments in other fields to its purpose.

A month or so ago a squad of police in New Jersey went to arrest a former convict wanted for bank robbery. He opened his door at their knock and turned an automatic pistol on them, killing two and mortally wounding two others. Then he fled to the attic, closing a trapdoor on his pursuers. There was no escape for him. But how was he to be captured? He was armed and had shown that he would not shrink from murder. Starving him out was likely to prove a long and dangerous process. But science gave the prisoner to the law.

A detective obtained several of the tear-gas grenades, kept for use against mobs. Cautiously the officer opened the trapdoor and tossed in a grenade. The fugitive began to cough painfully as the fumes spread through the attic. Then the trapdoor was slowly raised and the man descended to surrender.

Knowledge of anatomy, physics, and psychology, too, are vital to the law. Such knowledge enabled the authorities to bring to justice the murderers of "Honest John" Bruen, a wealthy New Jersey circus proprietor, about a year ago.

From a pair of footprints in the ground a few feet from the window through which Bruen was shot, detectives were able to describe the murderer as short and slight, facts read in the depth of the impressions and in their shape.

The job of finding the one short, slight man who might have shot Bruen among the many who answered that scanty description required long and patient work, but the detectives at last succeeded. Then, by adroitly questioning the man—that is, by the use of applied psychology—they drew from him a confession that proved him the murderer and the dead man's brother-in-law the instigator of the crime.



© Keystone

Chemically intensifying fingerprints on a window pane

Motor cars, motor boats, radio, the telephone and telegraph and airplanes were pressed into service in spreading the net that eventually enmeshed her.

This instance illustrates a dramatic feature of the bitter warfare between the police and the criminal. For years the latter has made eager use of the new developments in science to further his depredations against society. The oxyacetylene torch, for example, by whose fierce heat the stoutest metals may be cut like butter, was quickly seized on by the safe-cracker, who has used as well the most violent explosives devised by



© Keystone

Radio, machine-gun, and motorcycle car combined is a swift and deadly pursuer of violators of the law



© Keystone

Broadcasting a police alarm. This radio apparatus has a range of 30,000 square miles



This use of practical psychology—or, to call it by a simple name, keen understanding of human nature—is one of the most effective weapons of the modern detective.

Not long ago a New York detective was asked to find who had caused a package of valuable securities to disappear from the vault of a great banking institution. The four employees who had access to the vault were sent to him one at a time. Twenty minutes later one had confessed.

### Psychology in Action

Assuming that the four employees, informed that they were to be questioned by a police officer, would expect to be treated more or less severely, the detective adopted an attitude anything but formidable.

The guilty man, prepared to offer defiant denial of any knowledge of anything connected with the theft, was disarmed by the detective's manner.

"If you know anything," the officer said, "I'd advise you to speak. There's —," mentioning the name of one of the employees previously interviewed. "I hate to think he did it—a young man, married only a year, with a baby and a little home he's just bought."

He continued in similar vein, never once suggesting that he suspected the man before him, leading him to believe that the other members of the department, "—" particularly, were under suspicion.

At last the clerk broke down and confessed. He wanted to escape suspicion and punishment, of course, but he was not able to see a man who had worked beside him suffer for his wrong.

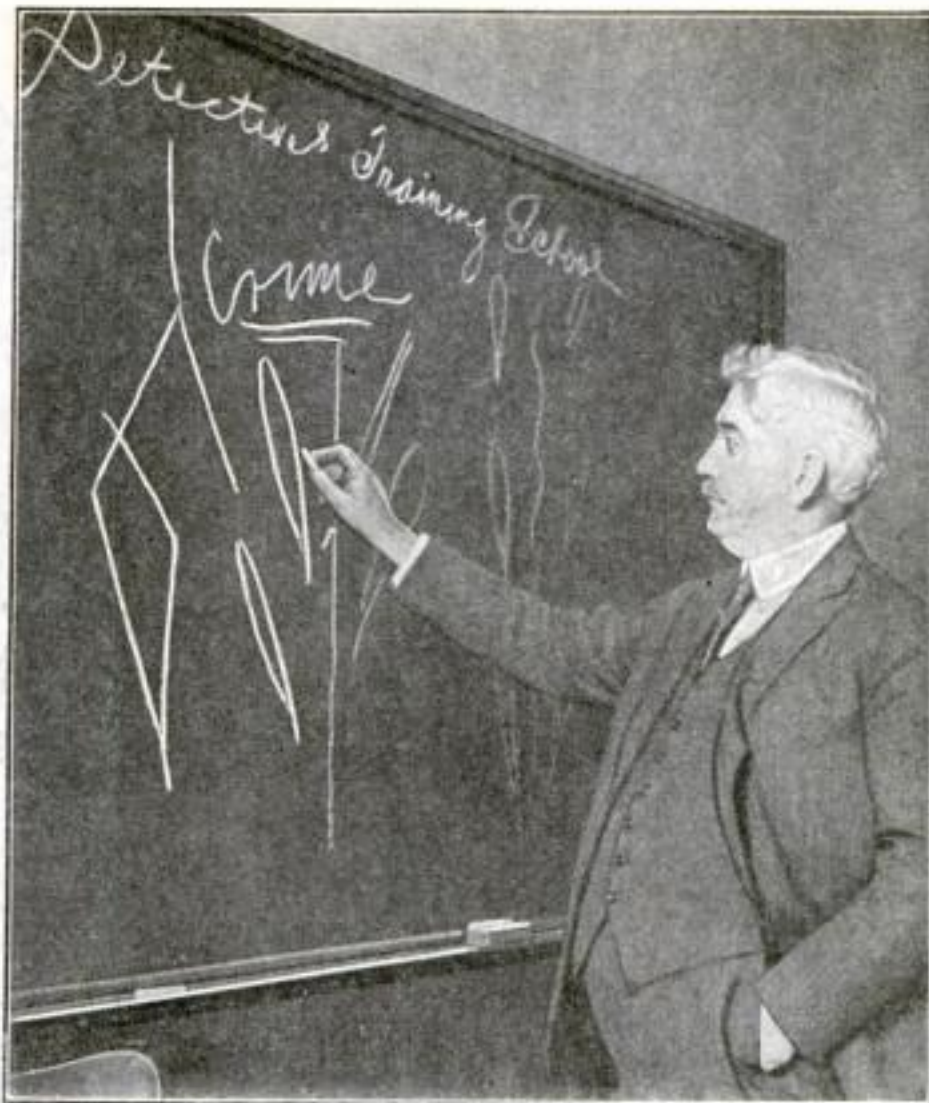
The detective who understands practical psychology can vary his form of questioning to get the information he desires from habitual criminals and amateurs alike.

Psychology is a major subject in the school for detectives that we opened recently in the New York Police Department. Study of mental impulses, emotional stresses and motives

is made. Members of the department are taught, too, to better their memories and sharpen their perceptions by the use of psychological principles.

Criminology also is studied, the policeman being taught to differentiate between the various criminal types and to use definite methods of approach and questioning in his investigations.

Practical details of police work, such as shadowing suspected persons, concealing identity, and using descriptions to pick persons from a crowd, are taught by means of clearly defined principles.



Richard Enright, Police Commissioner of New York City and author of this article, illustrating a lecture before that city's famous detective training school, which he founded

**C**RIME costs Americans unnumbered millions annually—more than enough to pay the nation's income tax. An impressive share of this is paid directly or indirectly by your pocket. Every advance of criminal science, by making crime more perilous and hence less attractive, saves you money and guards you from harm.

Commissioner Enright, one of the world's most distinguished authorities on crime and criminals, here outlines the scientific technique of the modern sleuth.

He goes farther, venturing this startling prophecy:

"In time science will cause premeditated crime virtually to vanish from the earth."

Through finger-prints accidentally left at the scene of the crime, every one who reads the newspapers knows, the perpetrator is frequently discovered, scientific methods having been devised of intensifying prints left on doors, articles of furniture, weapons, and window-panes, so that they may be photographed. With the coming of radiophotography, these finger-prints, and in some cases actual photographs of the criminals, will be flashed all over the country within a few minutes after the discovery of a crime.

### How Chemistry Helps

Chemistry and the microscope are additional scientific means frequently employed in investigating crime. In detecting bloodstains on clothing, studying inks and paper in forgeries and similar cases, investigating arson, narcotic and poisoning cases and in the performance of autopsies, chemistry is widely used, with the microscope as a valuable adjunct. More than once the analysis of mud on a prisoner's shoes or clothing has proved his presence at the scene of a crime. Under the microscope,

typewriting done on different machines and by different persons has been shown to possess as many points of variance as the penmanship of individuals, a fact that has proved invaluable in the unraveling of many crimes in which typed documents were fundamental evidence.

The action of the heart is the basis of a number of methods for compelling prisoners to tell the truth. The heartbeat, the blood pressure, and the rate of breathing, medical men have found, vary considerably under stress of sudden excitement, such as might be occasioned by hearing a damaging question and endeavoring to supply an untruthful answer. Accordingly, there has been devised apparatus, which, when connected with the subject's body, records graphically the action of the heart and

lungs and shows variations that may arise from the mental strain of fabricating an answer to a pointed question.

The recent remarkable development in radio communication already has been used by the police in their war against the criminal.

In time—although how soon I should not care to predict—science will cause premeditated crime virtually to vanish from the earth by making the hazards of wrongdoing too formidable to challenge. We shall then have to deal only with crimes committed in sudden passion.



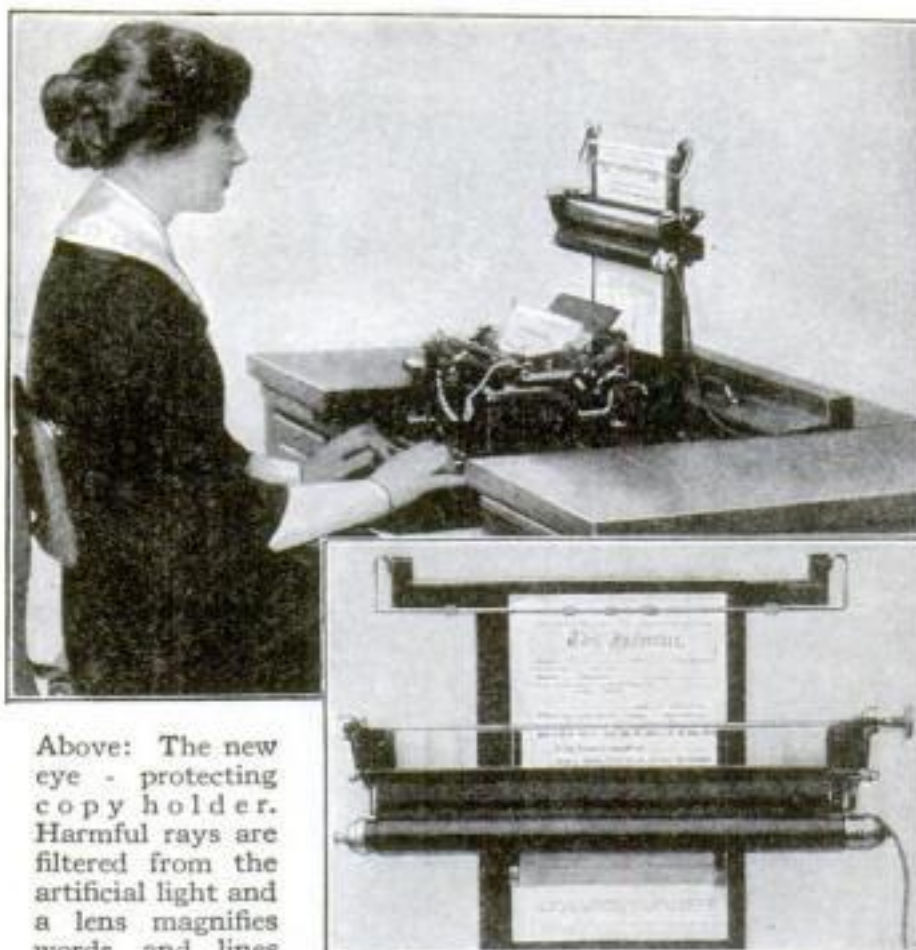
A man can lie, but science has shown that he cannot force his heart and lungs to lie also. A false answer accelerates their action and the apparatus shown above records these variations, revealing the probable falsehood they betray



## Copy Holder Prevents Eye Strain

**A**N INGENUOUS copy holder for typists that combines several unusual features is the latest stenographic luxury offered by inventive science. An upright frame attached to the typewriter at the rear holds the copy. The latter is moved into view a line at a time by the action of the machine's spacing lever.

An electric light, from which the ultra-violet and infra-red rays that sometimes injure sensitive eyes are filtered, illuminates the line to be copied. The line is made still easier to read by a longitudinal lens that adjusts readily.



Above: The new eye-protecting copy holder. Harmful rays are filtered from the artificial light and a lens magnifies words and lines



## Ash Dust Nuisance Ended by Sliding Can Top

**T**HE householder who must serve as valet to his furnace all the winter undoubtedly will be interested in the device shown in the illustration above. It is an ash dust eliminator, which permits him to empty the ashpit without covering his clothes with dust and inhaling it.

The appliance is placed over the top of an ordinary ashcan. When a shovel of ashes is to be thrown in, a pedal lifts a sliding door. Withdrawal of the foot permits the door to fall back into place, thereby imprisoning the cloud of dust.

## A Cane, a Saw, and a Seat Are Cleverly Combined

**I**T'S a cane, also a seat, likewise a saw. The handle of this versatile cane is in two sections, each of which can be swung in opposite directions to a horizontal position and clamped there. The cane is thus converted into a temporary seat or stool capable, it is said, of supporting 250 pounds.

The cane, in spite of its capacity for bearing weight, is hollow, and contains a narrow-bladed saw, which is made available by withdrawing the handle. See picture below.



It looks like a cane, but within a minute it can be converted into a seat or a small wood saw



## Asphalt Shingles Interlock

**T**HESE workmen are covering a roof with the new hexagonal asphalt shingles that lock together on the roof. One corner of the shingle is doubled under and the double thickness is pierced by a galvanized metal strip projecting slightly beyond the edge of the shingle. This strip and the doubled portion hook into the space between the shingles, interlocking them.

## Ingenious New Locknut

**S**HOWN here is a locknut for security where strains and vibration tend to loosen ordinary nuts.

The lower nut is screwed on the bolt, which has two opposite flat surfaces. A V-shaped spring washer slips on, its square central opening fitting the bolt's flat surfaces. The washer's two under faces have each a shoulder that engages the shoulders of the lower nut.

Another nut with notches in its lower face is screwed down against the washer. The washer's V points lock into the notches of the upper nut, thereby locking both the washer and the upper nut in place.



## Heater-Fan Stool Aids in Shoe Fitting



A switch controls heater and fan attached to stool

**F**OOT-EASE powder and the deft hands of the salesman are now supplemented by another important ingredient of shoe-purchasing comfort. The salesman's stool pictured herewith contains a small electric heater for cold or slushy days and a small electric fan for hot days.

The sense of comfort that induces a purchaser to accept a pair of shoes as her particular pair thus may be contributed to by obtaining the ideal foot temperature for fitting, says the inventor.



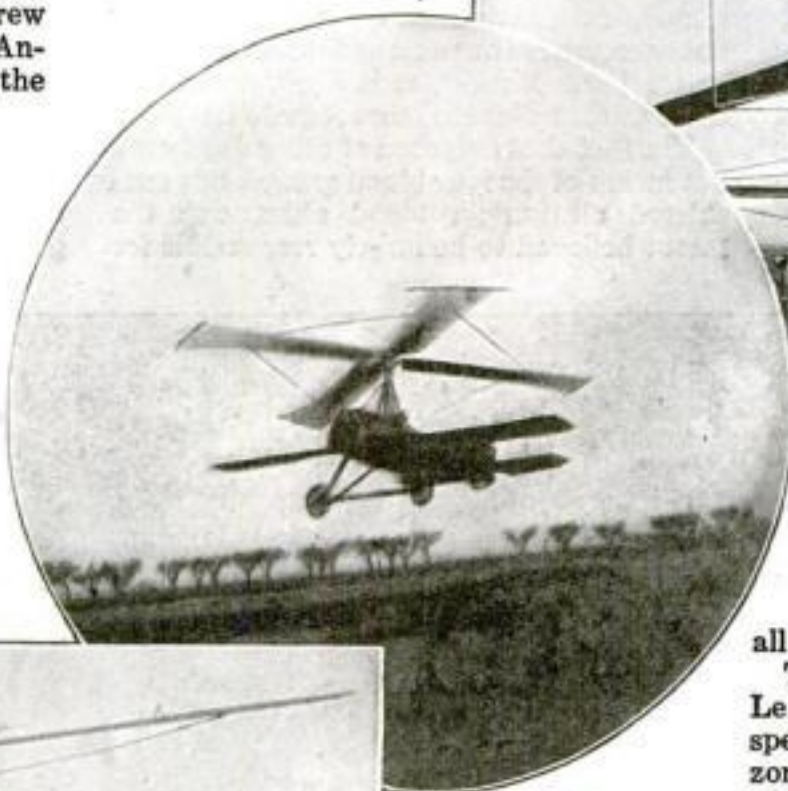
# Self-Stabilizing Plane Lands in Small Space

**F**ROM long experiment and repeated failure, a Spanish inventor, Juan Lacierva, has developed a new type of airplane, the "autogiro." The name is derived from the self stabilization accomplished by a four-bladed horizontal screw turned by the wind produced in flight. Another remarkable ability claimed for the machine is that of landing with virtually no forward speed and within a few feet. It is said to fly successfully without lateral control, and locking the elevator controls affects the behavior of the machine in no way.

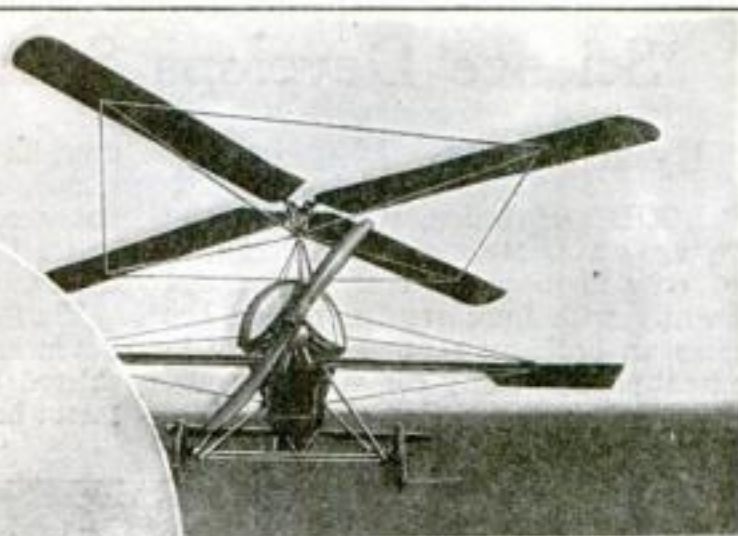
The machine is not a helicopter. In a helicopter the blades that seem to correspond to those shown above the Spanish machine are the actual propeller. In the "autogiro" this four-bladed screw is a sort of wind vane, not connected with the power plant.

The vane is not controlled by the pilot, but the blades are so arranged

Below: The "autogiro" in flight a minute after taking off



Left: The remarkably light construction of this latest departure from established aeronautical design. Note the small wings made possible by screw stabilizer



Above: Position and construction of the unique four-bladed stabilizing vane

that they adjust themselves to the machine's motion and to the centrifugal force of their own rotation. This automatically insures stability under all conditions, even in making a turn.

The plane, driven by an 80-horsepower Le Rhône engine, is said to have attained a speed of from 40 to 55 miles an hour in horizontal flight. The velocity of the blades of the "autogyroscope" is greater than the forward speed of the machine at any time when in flight, the rapidly revolving screw acting both as a stabilizer and as a brake, giving a wide range of speeds and angles of flying. Its tendency to "brake" the machine permits the making of landings in limited spaces.

The "autogiro" weighs about 1100 pounds loaded.

## Helicopter to Try for \$250,000 Prize

**P**ERHAPS the most striking fault of the modern airplane is that it requires a large area for ascension and landing. In war, when fire, shell destruction, or engine trouble compel a flyer to descend, he frequently loses his life and his plane because the shell-pitted and wire-tangled terrain affords no safe landing.

Even the peacetime activities of aviation involve occasional necessity for quick descent. A plane carrying the governor of Oregon to California a year or so ago suffered serious engine trouble above the Siskiyou Mountains. Landing would have been involuntary suicide. Fortunately, the pilot accomplished a belated makeshift repair and outwitted the danger.

A helicopter—a flying machine capable of rising and descending perpendicularly—would virtually eliminate these hazards. Also it would permit more rapid ascension. The British Air Ministry, aroused to the need for such a device, some time ago offered a \$250,000 prize for a completely practicable helicopter.

The machine illustrated here will contest for that prize. It is a 15-foot, U-shaped tunnel of wood, aluminum, and canvas inclosing the top and sides of a double motored lifting device equipped with twin propellers. The driving of wind under the canvas is expected to raise the helicopter perpendicularly with considerable speed.



The new Curtis V-2 tunnel type helicopter

The machine will be provided with two 200-horsepower airplane motors, each driving a 10-foot propeller.

The pilot sits between the motors.

## Carburetor Uses Kerosene at Higher Engine Speeds

**A** TWIN-BOWL carburetor that supplies gasoline until the engine has been running long enough to use kerosene, whereupon it supplies only the latter, now is offered the car owner. It is the invention of a Miami, Fla., man.

The device much resembles the ordinary carburetor, except for its two bowls. These are connected with the intake manifold, which contains a two-way leaf valve actuated by the air taken through the manifold. The gasoline bowl is in position when the car starts. But when the air velocity through the two-way valve reaches approximately 200 feet a second, it causes the bowls to shift and kerosene to be fed to the motor. As kerosene cannot be used in throttling down, this action is reversed when the air velocity falls below 200 feet. The valve can be adjusted to a different air speed, so that a motorist gets full mileage from any fuel.



# Professional Donors of Blood

## Science Develops Strange New Way of Earning a Living

By Robert E. Martin

**B**LOOD transfusion, which 10 years ago was a rare operation, resorted to only in desperate emergencies and frequently with fatal results, to-day has become an ordinary routine operation in the treatment of many common ailments. Physicians have found that the transfer of blood from one person to another is an effective treatment for at least 28 specific maladies, including typhoid fever, pneumonia, coal-gas poisoning, hemorrhage, infections, blood-poisoning, shock, and many debilitating conditions.

### Danger Eliminated

New knowledge of the nature and methods of the operation now enables surgeons to perform it with no danger either to the person who gives the blood or to the patient who receives it. In fact, so common and so safe has the operation become that many persons are earning their living either wholly or in part as professional donors of blood. Attached to every large hospital is a group of 30 or 40 healthy men who are on call by telephone at every hour of the day and night, ready to hasten to the operating room and save a life by giving a blood transfusion.

The faculty of one of the largest universities in the East announced that several students were helping defray their college expenses by giving blood for transfusion. Within the last few weeks the police of Washington, D. C., were required to submit to blood tests as a means of determining their fitness to give blood in the operating room. Members of the fire department also are to be tested.

The development of the science of blood transfusion is due almost entirely to discoveries made by American surgeons since the beginning of the World War. Most important of these was the discovery that not all human blood is alike, but varies in biological qualities, just as coloring of hair, skin, and eyes differs among members of the Caucasian race.

Surgeons now know that there are at least four main classes or kinds of blood, with many subdivisions between each class. They know, too, that quality of blood is inherited, just as yellow hair and blue eyes may be inherited. How-

ever, like the physical characteristics mentioned, an individual's quality of blood is not necessarily the same as that of his father or mother. Rather, it is likely to be the same as that of some more remote forebear.

The fact that surgeons of other days were not aware of the four blood groups, but considered all human blood alike, was the factor believed to be largely responsible for

Moreover, if the blood of a person belonging to one group is introduced into the veins of a person belonging to another, it may cause the red blood corpuscles of the patient to "agglutinate"—that is, to stick together in large, compact masses that choke up the tiny capillary veins, impede circulation, and cause fever. Hence, surgeons now select as the giver of blood a person whose blood belongs to the same group as that of the patient.

The patient's blood classification is determined by mixing samples of his blood with serums prepared from the blood of persons whose "blood groups" are known. Usually, with professional blood-givers on hand, the surgeon selects several belonging to the same blood group as that of the patient and repeats the tests, mixing their blood and that of the patient under the microscope in order to be certain that, while they belong to the same group, they do not belong to certain subdivisions thereof. Through these tests, the surgeon is assured that he may attempt the operation safely.

Where once it was necessary to dissect an artery from the donor's arm and sew it to the patient's artery—a complicated process requiring a large incision—recent development of ingenious apparatus makes it possible now to perform a transfusion in which a pint of blood is exchanged in a few minutes and with no incisions larger than the injection of hypodermic needles into the veins of patient and donor. Neither suffers pain, inconvenience, or shock.

Although professional donors are being used more and more, recent investigations indicate that better results are obtained by using the blood of a relative or friend of the patient, provided a person in the proper group will volunteer. A healthy man, surgeons say, is not harmed by the loss of a pint of blood; but six transfusions a year are about as many as the strongest person can stand. In consequence, surgeons endeavor to prevent blood donors from making their "profession" too profitable by submitting to transfusion too frequently. Those who elude the vigilance of the surgeons and give blood oftener than is advised, lose vitality, become feeble and pale, and their blood under test is found to be thinner and weaker than that of the patient.

Medical men believe that the scope of usefulness eventually will be extended beyond the treatment of the 28 maladies for which blood transfusion now is being employed. In the meantime, the operation has been made safe and comparatively simple; safe for the patient if proper tests are made before the selection of the blood donor, and safe for the donor if he does not attempt to submit to the operation more often than the surgeons advise.

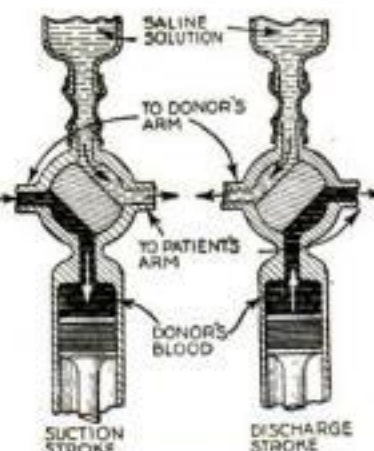


Testing blood of police officers at Washington, D. C., to determine their fitness as volunteers to supply blood for emergency blood transfusion

the serious consequences that once followed many transfusions. A few years ago, when a transfusion was decided upon, a father, brother, or some other close relative would volunteer to give the blood needed by the patient. Although people near of kin always have been referred to as of the "same blood," frequently they are not, according to the new blood classification.

	DONORS			
	GROUP I	GROUP II	GROUP III	GROUP IV
GROUP I				
GROUP II				
GROUP III				
GROUP IV				

This chart illustrates how the four different kinds, or groups, of human blood react upon one another in the process of transfusion. The figure in each square represents the reaction of the blood group of the donor upon that of the patient. Dark clusters indicate "agglutination," or the sticking together of blood corpuscles, which impedes blood circulation. Thus, blood corpuscles from Group I are agglutinated by blood serum of any other group, while Group IV corpuscles never are agglutinated by other groups



Pump apparatus used in blood transfusion. Salt solution prevents coagulation



# Conquerors of Metal and Coal

Ninth Article in "The Story of Man and His World"

By E. E. Free, Ph.D.

**M**OST of us live, really, not on meats and vegetables, but on coal and also on iron.

By the mastery of these two materials, which has given us, in turn, tools and machines, man has been able to multiply the food supply of the world perhaps a thousand times.

We get our food nowadays, not so much from the mere natural productivity of the soil, as by the help of the metal that is the backbone of our civilization and of the black mineral that drives most of the machinery of the world.

## Coal and Iron Mean Life

If some magic power were to remove suddenly from the world all of our iron and coal, as well as the oil, our newest substitute (in part) for coal, nine tenths of the population would vanish in less than one generation.

Without iron tools the farmer could not maintain the yields of foodstuffs from his acres. Without coal to make steam and run our railways and steamships we could not move even what food there was to the places where people were waiting to eat it.

The vital importance that these material things—coal and iron and oil—have come to have in the world of living matter is another instance of the fact that I have emphasized so many times in this series of articles—the fact that evolution is not all over and done with, but is going on in the world every instant, right here and now.

The story of evolution did not stop with the perfection of man's body or with the discovery of civilization or of speech. One of the main scenes of this story, a scene as significant as any of them for the future of man and his world, is that which shows the gradual conquest of materials like the metals and of power like that we get from coal. Today, right under our eyes, there is going on this conquest of the world by man, a conquest for which the long history of man's bodily evolution was merely the preparation.

The first step in the progress that has given us, in the end, our mastery of coal and iron, was the discovery of the first metal. This happened long before the beginnings of written history, but something of how it came about we can read from



A turning point of life. How the ancient caveman, finding a spear-shaped piece of copper in his fire, may have discovered the use of copper, thus beginning the long progress from barbarism toward the modern Age of Metals

the relics that have come down to us, from the gold beads and bits of copper and fragments of iron tools that scientists have dug out of the discarded rubbish of the ancient villages.

The first metal known to man was undoubtedly gold. This fact is easily explainable. An ape-man bending down over the

water, intent to clutch a fish, or a thirsty cave dweller braving daylight to gulp a drink, saw shining on the stream bed the little glittering lumps that seemed beautiful enough to be alive. Once in a while he took some of them home with him; some were the clear crystal pebbles that we call gems, some were the heavy yellow lumps of gold. Thus began the gathering of treasure.

## Our World Built on Beauty

It is significant that this finding and keeping of gold, which was the first step toward coal and iron, was, at bottom, a response to beauty. The ape-men gathered gold, not because they needed it, but because they liked it. This is an answer for you to give the materialist when he tells you that beauty is of no use in the world. Say to him that the material civilization of which he is so proud, the coal-iron basis of all our boasted wealth and artistry, began, literally, with the attempt of ancient men to carry home a little bit of beauty.

The second and less important step toward coal and iron was the discovery of silver. Like gold, it was first gathered because it was shiny. It, too, occurs in the rocks as the free metal.

But though gold and silver were the beginnings of this material conquest, they were not themselves its instruments. So far as we know, no man ever made tools of them. They were ornaments, treasures, objects of art in ancient times, just as they are today. The first *useful* metal was copper.

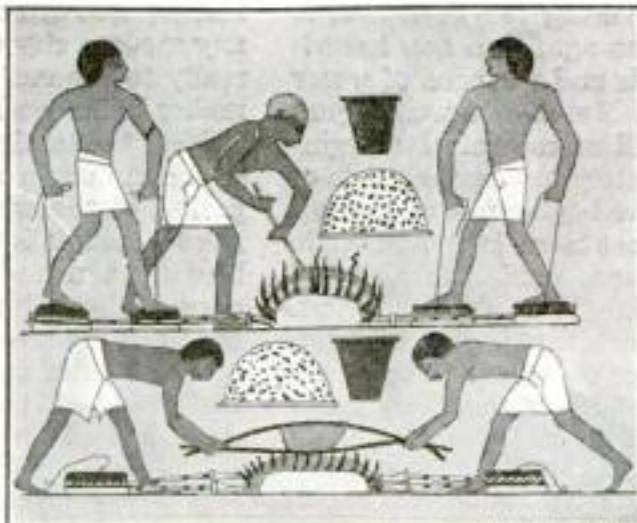
The most ancient copper objects found are about 10,000 years old.

They were recovered from the lowest strata of the ancient village site at Anau in Western Asia, which is about the locality, if you remember our chapter on the men who invented civilization, where human society first began. These earliest known copper objects are beads and little plates and rods. It is unlikely that they could have had any use. Probably they were merely ornaments and treasures.

## Drama around Primitive Fires

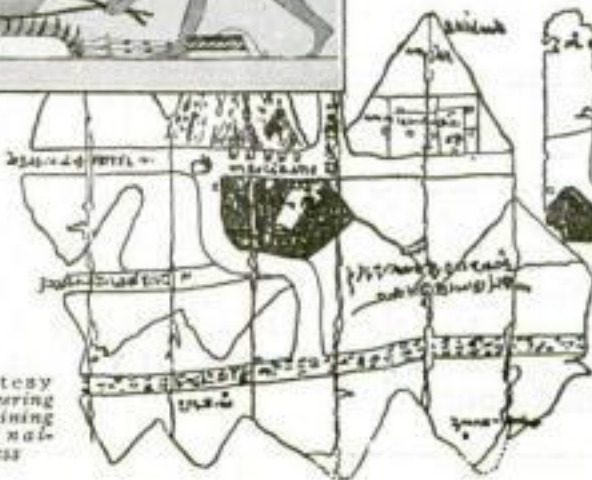
But how did men come to have them? Copper nuggets are not found loose in streams. We cannot believe that primitive men acquired all at once, by inspiration, the skill to get the metal from its ore.

The most plausible suggestion is made by the distinguished English archeologist, Lord Avebury. It may have happened, he says, that primitive men, when they built fires for cooking, accidentally got into the fire some chunks of rock that contained copper. The heat would melt out this copper. Later on, some curious individual, hunting through the ashes, would find the little metal beads. Such copper beads



How the ancient Egyptians smelted metals with foot bellows (at left). The bellows were filled by raising the foot and simultaneously pulling the string. Then foot pressure forced air into the fire

The most ancient mine map in the world (at right). Drawn by ancient Egyptians on a piece of papyrus, it shows a gold mine that was worked more than forty centuries ago



Courtesy Engineering and Mining Journal Press



would be considered, of course, merely another variety of the "shining stuff," the gold and silver.

If we may judge from the remains of Anau, it was some centuries, perhaps as much as 1000 or 1200 years, before anybody made the next important discovery about metals—the discovery that copper could be used to make tools.

This discovery, when it came, was another of the turning points in the progress of life. Henceforth man was to make his own materials. His face was set toward the mechanical, power-using civilization of the present, the civilization that we have called the Age of Coal and Iron.

### Men Find a Use for Beauty

This discovery of the usefulness of metals, as contrasted with their mere beauty, seems to have happened about 8000 or 10,000 years ago. In those days the tools of men, their spearheads, arrow points, needles, and fishhooks, were made either of flint or of the harder kinds of bone, such as ivory. The chief industrial material was stone. Men had quarries here and there over the world where a good quality of stone was to be obtained. From these quarries the crude flints or the implements manufactured from them by skilled workmen were carried by a sort of rude commerce all over the neighboring parts of the world.

Now this established use and commerce in flints was a very important preliminary to the use of copper. Men knew all about flint tools. The spear or knife of well worked stone was as familiar a thing then as a pocket knife is now. And it is a

very significant fact that the first spears and knives of copper copy exactly the shapes of the earlier ones of stone.

The meaning of this is clear. The first man who made a copper spearhead made it to resemble a stone spearhead. But what made him think that he could do this?

### Learning How to Shape Copper

Here again we must imagine, I think, the occurrence of a happy accident. Some day a potter or a hunter making ready to cook his food, built a fire more than usually large and hot. There was copper in it, too. The copper melted out as usual, but instead of making merely beads among the ashes, there was enough of the metal to run out in a stream and make a thin plate-like form that may have looked like a spearhead, knife, or some other implement already familiar among the various tools of stone.

The cavemen, if not intelligent, were observant. A metal shape like a spear would not fail to be noticed. From this it was a natural step to trying it as a spearhead. Being tougher and less breakable than stone, the new copper shape would disclose at once its practical value. The active-minded

artisan would try, naturally, to shape it more exactly by the same method he used on his crude flints, that is by pounding it. In this fashion, then, men may have come upon the knowledge of how to get copper out of the rocks and of how to hammer it into useful shapes.

The next steps toward the Age of Coal and Iron were easy. The regular manufacture of copper from its ores, the making of



These pictures show vividly the growth of modern metallurgy. The photograph shows the removal of a whole mountain of copper ore at Bingham, Utah. At the left is a modern steel plant, producing more iron in a minute than the primitive blacksmith could have pounded out in his whole lifetime.

stronger and sharper implements from it, the discovery of the harder natural alloys of copper and tin that we call bronze; all were simple and inevitable developments from the first discovery of copper and of its use. By the time the civilizations of Egypt and Babylon were being founded, that is by about 6000 years ago, men had knowledge of copper tools and weapons of many kinds. The Age of Metals was well begun.

But iron was still unknown. Its beginnings are as completely lost in the mists of antiquity as are the beginnings of the use of copper. Ornaments of iron and little pieces of it that were used, probably, as magic stones were known in ancient Egypt. They may have been bits of iron meteorites. There is no evidence that the ancient civilizations used iron at all or that they knew how to get it out of its ores.

About 1500 or 1200 B.C., iron tools and weapons began to appear. The Aryan invaders who came down from the north into Greece and began the great Grecian civilization knew all about iron and used it freely. Lumps of iron were the highest prizes in the earliest Olympic games.

Where and how these men learned to make iron we do not know. It was a natural outgrowth, probably, of the previous industry of working copper. Men of inventive mind among the copper-smiths tried other sorts of rocks as sources of the red metal. Somewhere, by accident, somebody tried an ore of iron. With the charcoal of the wood fire the ore produced the metal, in exactly the same fashion, indeed, in which the so-called "Swedish" or "charcoal" iron was made in many parts of the world down to recent times.

### Early Iron Workers

The primitive iron, of course, was not very pure. It was obtained in little buttons or lumps. These had to be purified by heating and pounding on an anvil and gradually worked together into fragments large enough to make a tool. The art was much more difficult than the art of working copper. The men who mastered it were important men in the community, so important that they

took, with proper pride of accomplishment, the name of their trade for the name of themselves.

They were the first of the Smiths; called originally the "smelters," that is, the men who knew how to pound out the iron. The many pages of Smiths that you will find in any modern city directory are a monument really to the early importance of the iron-maker in the world.

With the taming of iron we have reached, so far as metals are concerned, the modern period of the world. Following centuries have added, it is true, several new metals—lead and zinc and nickel, and the still newer ones, such as aluminum and tungsten. We have acquired, too, a kind of artificial stone in the form of cement and many accessory materials such as glass and paper. But the essentials of the modern use of materials

had been achieved when one prehistoric genius had copied his stone ax in copper and another one had copied the copper ax in iron.

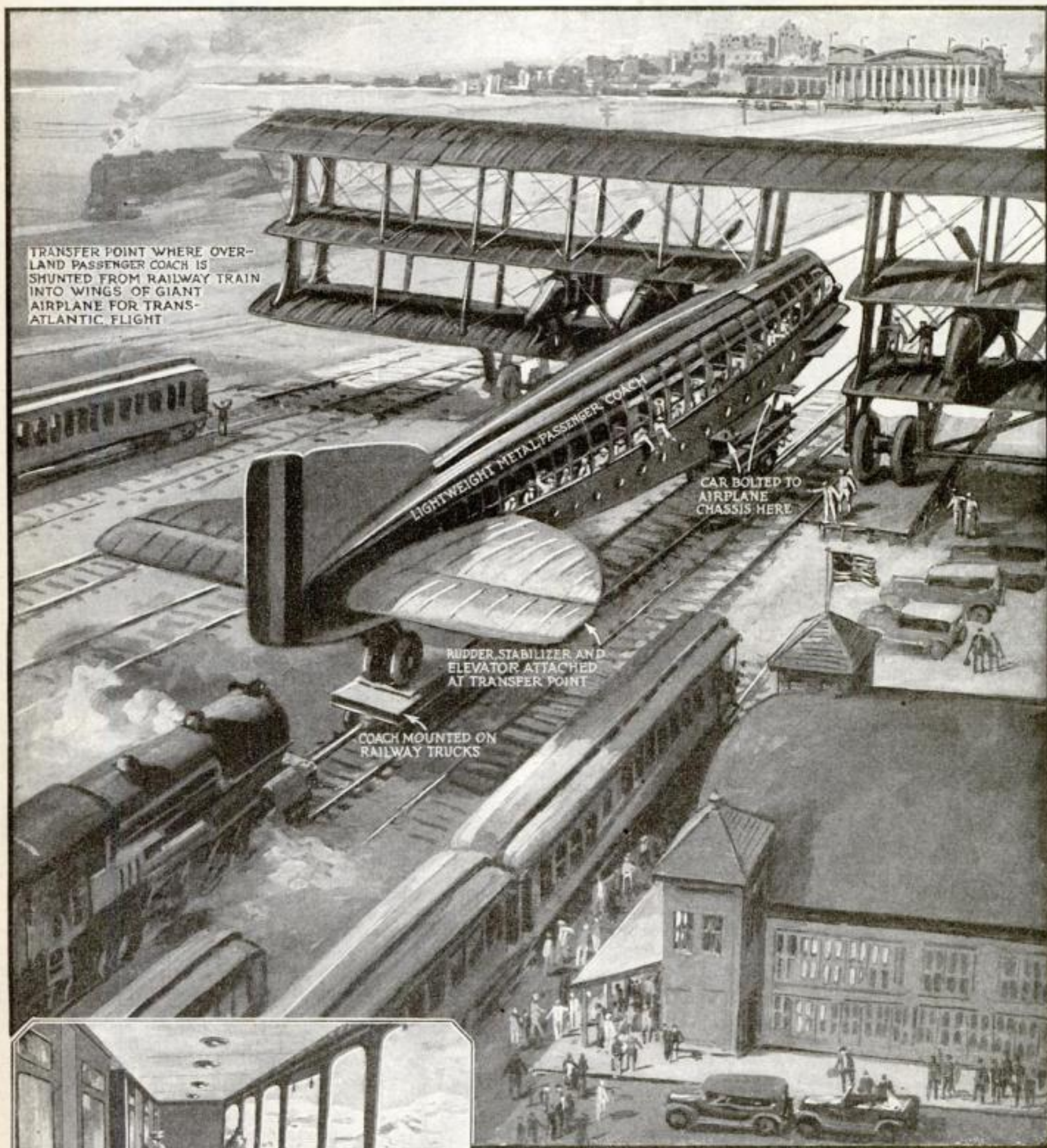
This had happened about 3000 years ago. Man had reached what historians call the Iron Age; but not that greater age—the Coal-Iron one. There was one more step, the conquest of mechanical power, of steam, and of coal.

(Turn to page 141)

"THE Story of Man and His World" will be concluded in next month's issue, with an inspiring article by Doctor Free, revealing evolution as the compelling law of the universe. He will show how the evolutionary theories apply even to the stars themselves, to the chemical elements, and to every other known thing on this earth, as well as to living matter and to man.



# Luxurious Railway Coaches May Take Wing



Above is shown the proposed transfer point where land-and-air passenger cars would be shunted from a transcontinental train into the wings of a giant airplane. At the left, a luxurious observation deck of the contemplated passenger car

**I**S A round-the-world journey—overland by rail and across oceans by plane, without changing cars—to be an aeronautical commonplace of tomorrow?

Late advices from England indicate that British engineers and inventors are approaching success in just such an adventure into super-transportation.

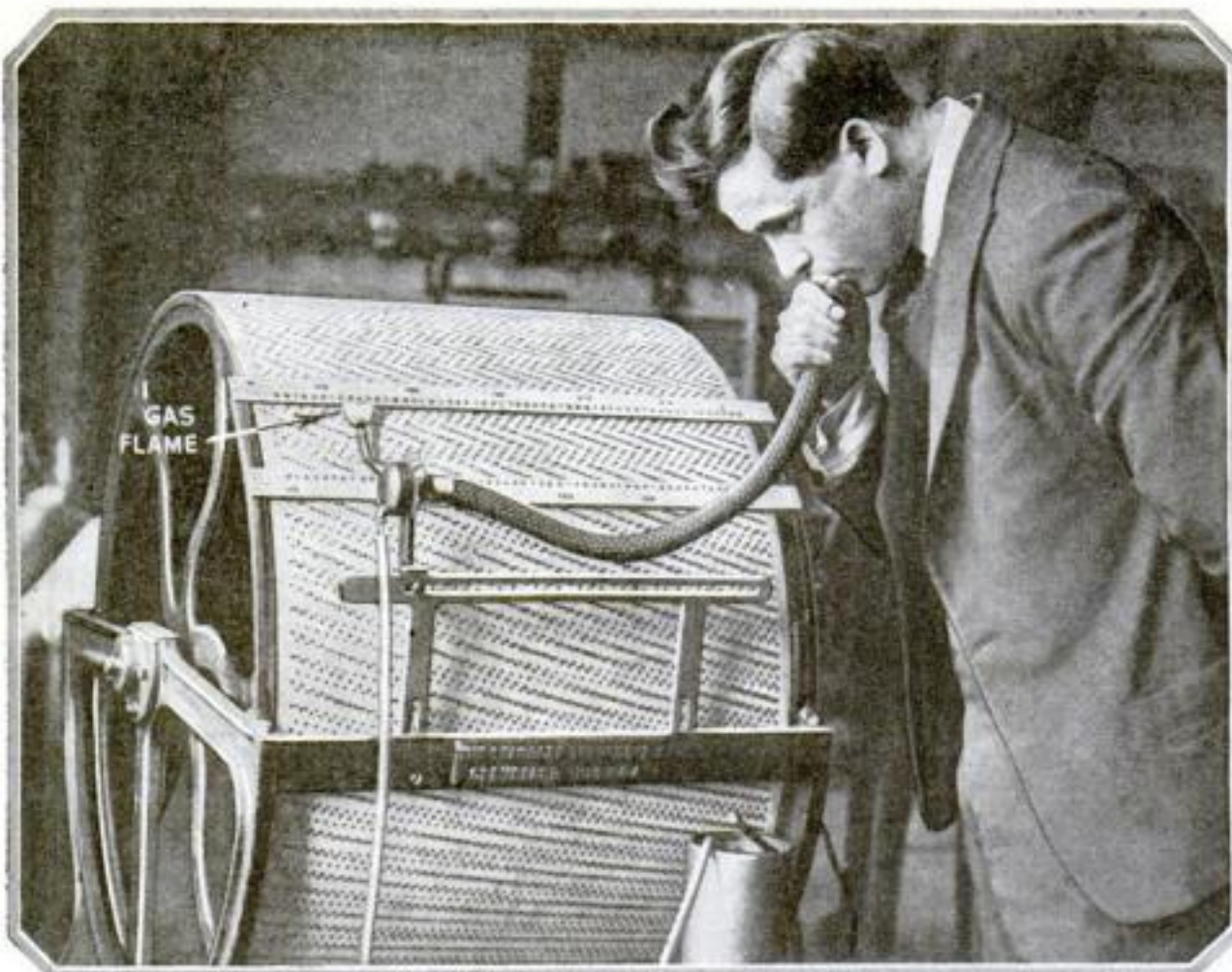
The project contemplates great passenger compartment cars to be transported

either on railway trucks or attached to huge airplane wings. Transcontinental trains, arriving at an air-drome transfer point, would shunt these land-and-air cars into the wings of a giant airplane. Thus, without waking in their sleeping accommodations, passengers would be racing on rails down the Hudson valley one hour, and on wings above the Atlantic the next. No time would be lost in rail and steamer connections, and rail economy would be combined with the tremendous speed of man-made wings.

The fascinating possibilities of such a scientific stride incite the imagination. We may foresee luxuriously appointed passenger cars, equipped to furnish entertainment and comfort to passengers. We may imagine ourselves as these passengers, one morning enjoying an Ohio landscape from the car windows; on the evening of the next day looking down upon the conquered Alps.

Engineers of the Pullman Company for several years have been studying the possibilities of aerial pullmans, and will be ready to construct them the moment aeronautical advance makes them feasible.





Voice analysis by observing a dot-covered revolving drum through a fluctuating flame

## Voices Made Visible and Analyzed by Science

**T**HE voices of some opera singers thrill us; others merely please us. Do you know why?

Scientists have known that the effect of a singing voice depends on two qualities—intonation, and vibration, involving the emotional qualities of the tone. But it remained for Dr. Max Schoen, of the Department of Psychology, Carnegie Institute of Technology, to explain why intonation so largely affects voice quality.

By careful analysis Doctor Schoen concluded that we can trace many of our likes and dislikes of singing voices to the manner in which the singer attacks, sustains, and releases each tone, or progresses from one tone to another. To demonstrate this theory, he developed a phonograph attachment to the tonoscope (shown above)—a delicate tone-analyzing instrument that produces a picture of tone vibrations.

The tonoscope consists of a large motor-drive revolving drum, painted white. On the white surface are painted 18,095 dots arranged in 100 rows. The first row has 110 dots, the third 111, and each succeeding alternate row one additional.

These dots are observed through a fluctuating gas flame that can be moved from row to row as the experimenter seeks the pitch of the singer's voice. The flame is caused to fluctuate by vibrations of the singer's voice on a diaphragm.

As the drum revolves at one revolution a second, the dots become blurred. The row behind the fluctuating flame, however, is seen to move up and down with a jerky motion. When a vocal tone strikes the diaphragm, the experimenter moves the flame along the rows until he finds a row that seems to stand still. A scale indicates the exact pitch of the tone.

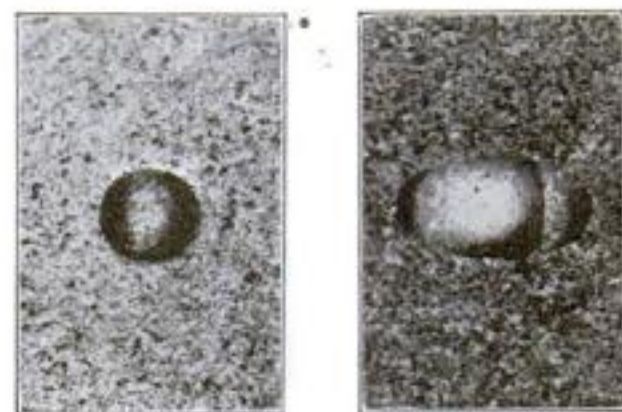
## New Instrument to Test Hardest Materials



Tests hardness by pendulum oscillations

**A**N INGENIOUS instrument for testing the hardness of materials has recently been developed in England. It consists of a frame, supported by a ruby or steel ball, which, when placed on the material to be tested, oscillates like a pendulum. A curved spirit level at the top of the frame, supplied with a scale, permits observation of the distance traveled by the bubble when the frame oscillates.

When the supporting ball is placed on a very hard surface, the pendulum vibrates



Left: Impression made by pendulum merely placed on the material. Right: After the pendulum has been stopped by hardness

through a great distance and for a considerable time. Placed on a soft substance—lead, for example—there is no oscillation at all. This furnishes an index as to the relative hardness of materials which is recorded in terms of the arbitrary figures furnished by the movements of the bubbles.

Two methods may be used for determining the hardness of a metal—observing the distance that the bubble moves from zero with the first oscillation of the pendulum or ascertaining the period required by the pendulum to swing 10 times.

## Claims Birthmarks Vanish under Radium Rays

**B**IRTHMARKS, even the dark red "strawberry" blotches, which disfigure so many faces, are said now to be eradicable through the potency of radium. At a recent meeting of the American Radiological Society, Dr. Lawrence R. Taussig, of the University of California, announced the successful use of radium rays in destroying a variety of birthmarks. He declared that no great time was required and that the eradication was not painful.

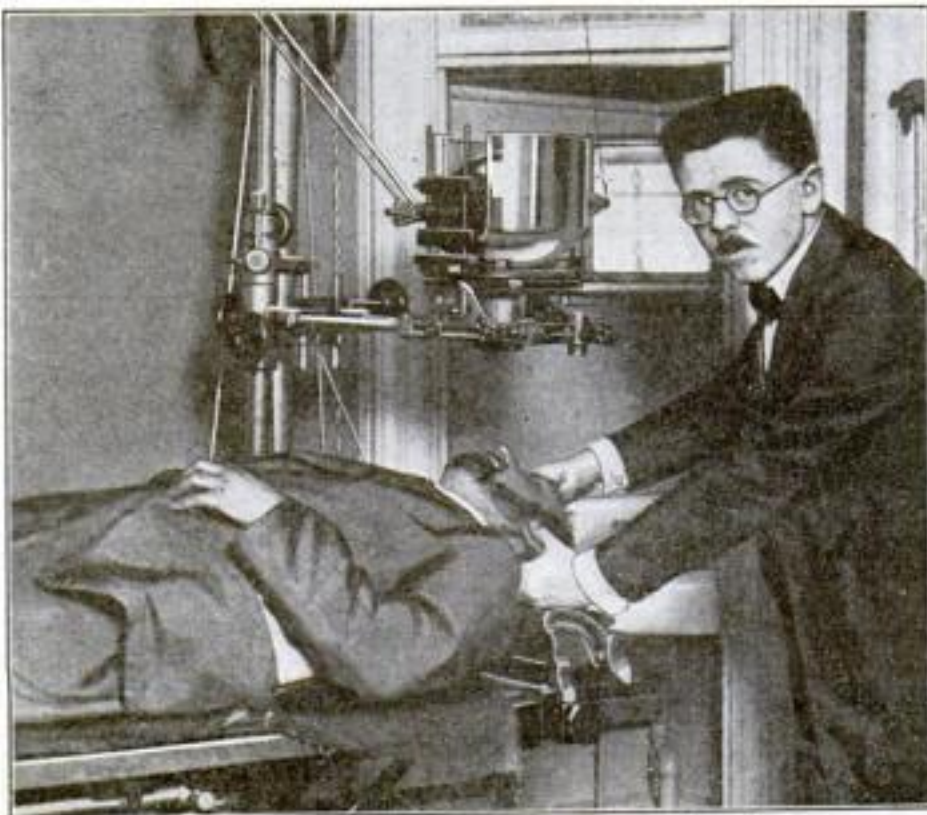
Dr. Lars Edling, Swedish radiologist, rendered tribute to the astounding progress made by America in radiology.

## World's Strongest X-Ray May Vanquish Cancer

**A**TACKING the still unconquered scourge of cancer with what is said to be the world's most powerful X-ray, Dr. Lewis Friedman, noted radiologist and cancer specialist, holds forth hope.

He announced recently that in a case far advanced, he had reduced one dimension of an internal abdominal cancer three quarters of an inch, using the phenomenal voltage of 250,000.

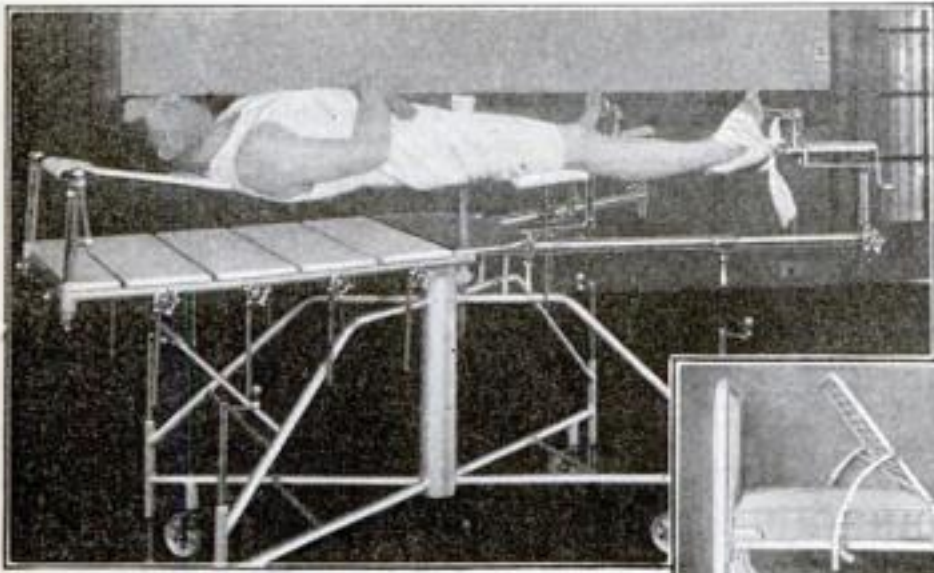
Doctor Friedman asserts that the rays from his machine are identical with some radium rays.



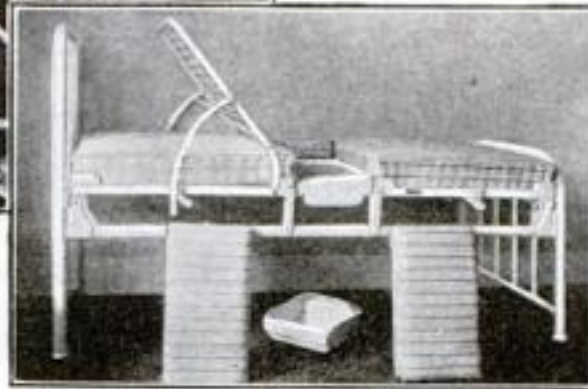
Dr. Lewis Friedman, cancer specialist, attacking the scourge with a 250,000-volt X-ray. He is hopeful of effecting cures



# Inventive Science Brings Comfort to the Sick



Left: An operating and fracture table that gives the doctor complete access to the body, yet is comfortable and free from strains to vital bodily parts



Above: An aerating bed that cools the body and prevents bed sores. Right: A vaporizer that uses an ordinary electric light socket

heated surface of a light bulb. A gauze screen about the device filters the vapor, keeping it fine and moist. The whole is attached to a light socket.

The third invention aerates the body for coolness and prevention of bed sores. A specially designed spring and a mattress made in four sections permit the pulling out of slides to create air currents about the body.

The two central parts of the mattress can be removed and a basin inserted in the opening. A back rest can be applied.



**T**HE inventive genius of curative science recently has created the three devices here illustrated.

The operating and fracture table supports the patient on a long, soft hammock from head to lower back in such a way that he is accessible for plaster from the top of his head to the base of his toes. Moreover, he rests upon a soft support that conforms to his body outline, prevents pressure and permits him to maintain a position that is practically that of a person lying in bed.

Croup kettles, steam atomizers, inhalers,

etc., it is claimed, have been made obsolete by this recently patented vaporizer. Wicks convey the liquid to be vaporized along the

## New Industrial Gas Mask Gives Greater Comfort

**T**HE gas mask, which became so crucial a factor in the closing years of the Great War, has found a vital place in industry, and many ingenious improvements have



been developed by the needs of peace. The latest development is this manifold hose mask used in oil refinery chambers.

It has neither mouthpiece nor nose clip, yet fits the face with perfect comfort and is airtight. Although, if special conditions require it, the usual filtering canister can be employed with this mask to use inside air, ordinarily the blower in the trunk shown supplies outside air from a distance. This blower can supply six masks at once.



## Pressing Bills Are Reduced by Leg Raincoats

**W**HAT man has not taken to the presser's a pair of trousers neatly pressed above the line where his overcoat or raincoat started doing its duty and hopelessly shapeless below that point?

Rain did this to a Kansas City inventor once too often. He retaliated by devising and patenting leggings of waterproof material, supported in position by adjustable telescopic supporters that engaged over the stiff edges of the wearer's shoes. These leggings shelter the normally exposed area and pare off excess presser's bills from the vaulting cost of living.

## Surprises for the Burglar Wait behind This Door

**I**T WOULD be a determined burglar who persisted in trying to enter this door. His first discovery would be that a stout chain prevented it from being opened more than slightly. His next discovery would be that in opening the door thus slightly he was sounding a bell, a bell that did not stop when his startled hand jerked away.

The bell operates without wires or batteries, being wound by hand when the bolt is set and spring-released by pressure.



## Polluted Oysters Cleaned

**A** COMMERCIALY feasible method for making oysters grown in polluted waters safely edible was announced recently by the Conservation Commission of New York. The mollusks are placed in three successive basins of chlorinated water, wherein they wash themselves clean. This process is claimed to be more effective than any method short of complete sterilization.



# Cable Supplants Pioneer Radiotelephone

**T**HE famous "talk bridge" between Avalon, Catalina Island, and San Pedro, Calif., the world's first commercially successful radiotelephone circuit, is being dismantled. Two telephone cables, each 27 miles long, accommodating seven simultaneous conversations, will replace it. The change resulted from the necessity for making possible more than one conversation at a time and from the request of the government



The cable coiling force at work in one of the great cable tanks aboard the *Dellwood*. Fifty-four miles of the cable were coiled and uncoiled

Below, two welders, protected by masks splicing armor wires with an electric arc



that the station surrender its wave length for use in broadcasting.

For a long time the radiotelephone conversations were audible to every amateur who cared to listen in. Telephone engineers then devised a method of "scrambling" messages so that they were audible

only to a receiving set specially designed and manipulated.

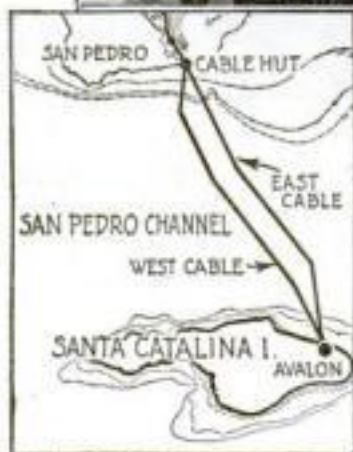
The new cables are composited to provide a duplex telegraph channel also. A copper sheath, concentric with the central conductor, is used for a return path. The multiple telephony possible

over the single central wire is accomplished by a system of varied frequencies, analogous to those used in radiotelephony.

Each of the two cables includes sections of four different types, each designed for a certain range of water depth. They differ in size of armor wire, jute coverings, and other protecting sheaths, but not in the size of copper conductors. The shore ends are the most heavily armored sections.



Above: The army cable ship *Dellwood*



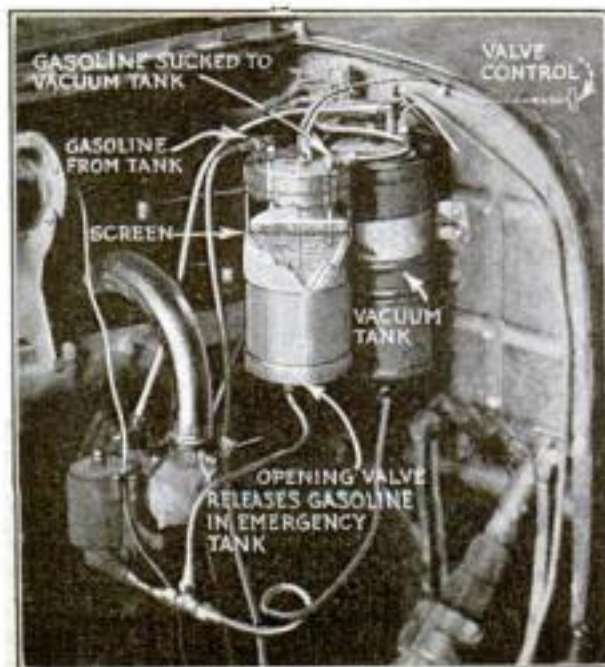
Left: Map of the route the cables traverse

## Vacuum Tank Is Kept Clean by New Filter Box

**N**O DIRT, sediment, or water can go into your car's vacuum tank, it is claimed, if you install this emergency gasoline tank.

All gasoline used is sucked into it through the main gasoline line and filtered through a copper screen. The gasoline then is picked up by suction, flowing through a pipe to the vacuum tank.

One gallon of filtered gasoline always is available in this emergency tank. Pulling a choke on the dash starts it to the carbureter. Pushing choke back refills tank.



Vacuum tank and gasoline kept clean

## Navigation Easier with New Rudder

**U**SING a principle that earlier he had applied successfully to the steering of airplanes, a German inventor has devised an auxiliary rudder for ships that is said to obviate the necessity for a steering engine.

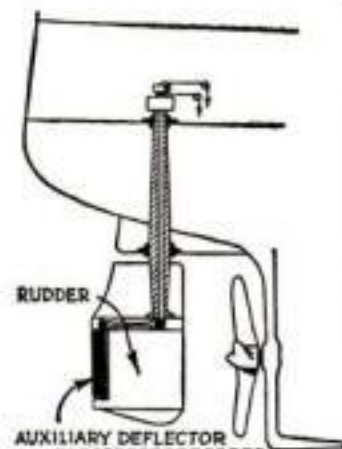
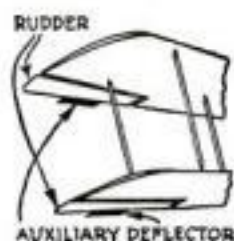
It is claimed also to keep the vessel on a straighter course.

The device is really an extra rudder, which performs the same function with re-

When the change in water flow ceases, an ingenious mechanism returns the rudder to its original position, the ship going back to its course much more quickly and comfortably than a steersman could send it back with the wheel.

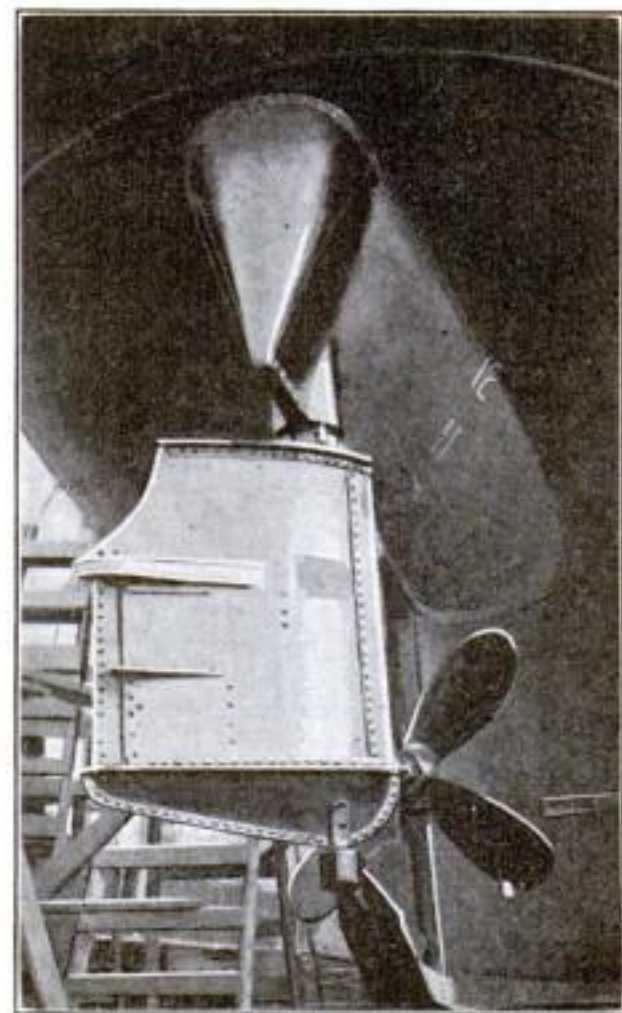
The device has been installed on several large ocean liners and is said to have been operated with entire success.

The auxiliary rudder principle originally was applied by the inventor to air navigation, with marked success



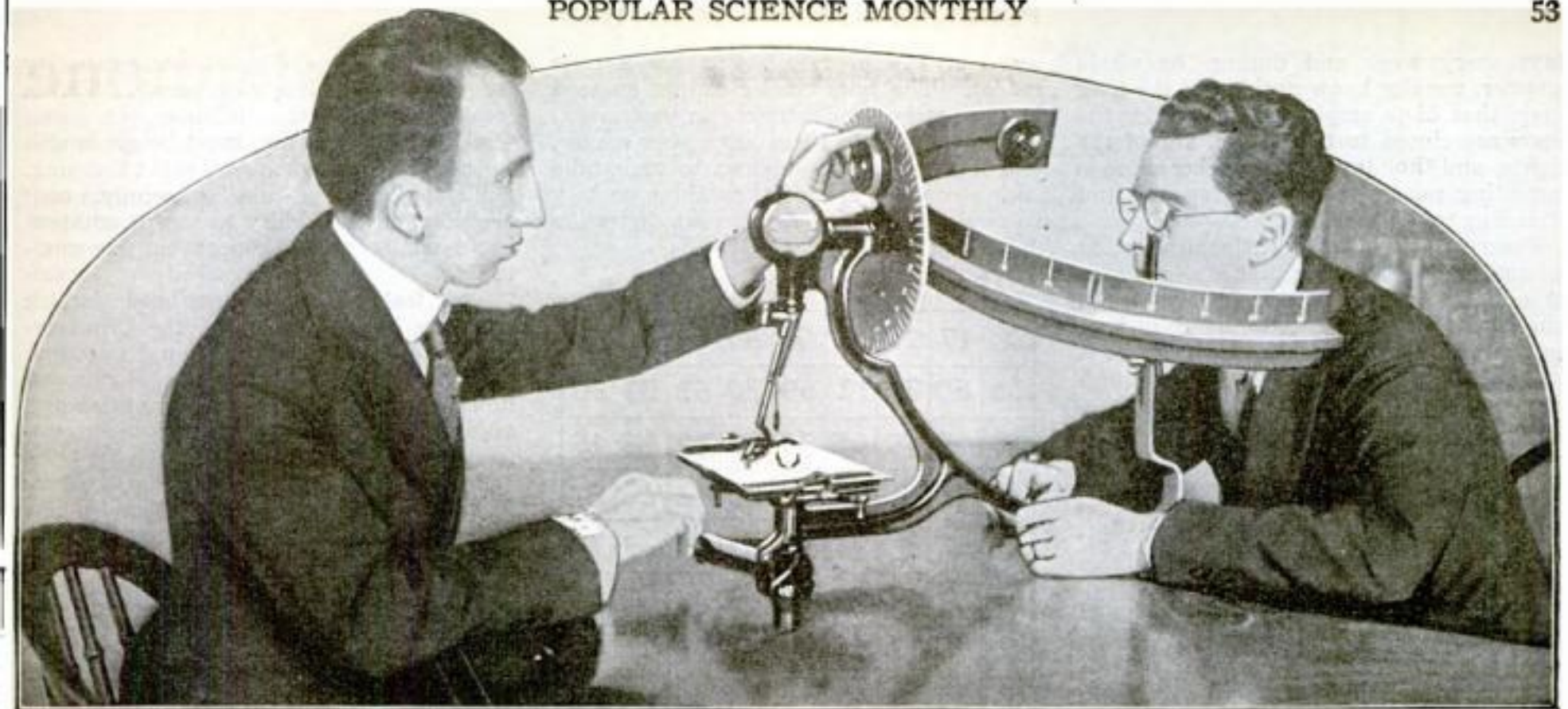
A sudden wave in a storm will shift the auxiliary deflector, which in turn deflects the rudder similarly, thus largely nullifying the effect of the wave

gard to the main rudder as the main rudder does with regard to the ship. Its movements are controlled not by the helmsman but by the flow of water past it. It hangs free to swing about a vertical axis and when deflected, say by a wave, causes the main rudder to be similarly deflected, nullifying sudden shocks and jerks. Previously these required a steering engine of several hundred horsepower, which placed a tremendous strain on the steering apparatus and on the hull.



A close-up of the new auxiliary rudder installation on a passenger ship





The color perimeter, which determines your field of vision and zones of color perception

# Are You in the Right Job?

By Herbert A. Toops, Ph.D.

Research Associate, Institute of Educational Research, Columbia University

**G**ETTING the right job has been a vexing problem to most of mankind since the birth of civilization.

Prehistoric man found his job laid out for him at birth, for he was entirely dependent upon his unaided, personal efforts in wresting his food, shelter, and clothing from nature, from wild beasts, and from other men. If he failed, he died.

But the "square peg in the round hole," the "rolling stone," the "jack of all trades," the men who never quite find that particular vocation for which their capacities fit them—all of these we have had with us since men first left their solitary caves and camps, settled in communities, and made specialized division of their work.

But the man in the wrong job need remain a problem no longer. Science has hit upon ways of determining the right job, or at least of making it possible for a man to avoid wasting time and effort on a job in which he is bound to fail.

• This new science may be called "vocation selection." It is exact. It is comprehensive, and it is so elastic that, once its principles are explained, almost any man of average intelligence may readily adapt them to test the aptitude of any one for any trade or profession.

It is based on the theory that the principal cause of vocational misfits and consequent failures is the haphazard, headlong way in which men rush into a line of work without first determining their intellectual fitness for it. No man of meager physique and frail strength would think of embracing such a career as blacksmithing, say, or lumbering.

## Is Your Job Big Enough?

**A**RE you wasting yourself in a job that does not use the best in you? "Four of every five men," says William J. Kibby, famous business psychologist and employment expert, "never find that work for which they are particularly fitted."

Such men offer their employers only those capacities that thousands have. They never use and never are paid for their valuable, often unsuspected, special aptitudes.

Ruts are hopeless only when not seen by those in them. If you feel that somewhere is a job in which you could be happier and more efficient, whet your mind on the tests Doctor Toops offers you here.

Read this inspiring article on how Science helps the man who has not found his right niche in the business world.

Yet men without number whose intellectual equipment is average or less, seek to succeed in professions and occupations that require general intelligence of the highest sort or intellectual qualities of an extremely special sort. Again, men of high intelligence often undertake work whose simple intellectual demands never can engage their hearty interest.

Early attempts to find for a man the job that suited him went not much further than inquiring what profession or trade interested him. This was better than forcing him into some distasteful occupation, but the limitations of such vocational selection are apparent. Many persons nowadays are interested in radio and automobiles and moving pictures. That obviously does not indicate that they should all be radio engineers, automobile manufacturers, or moving picture producers.

Personal inclination is often superficial and hence an inaccurate and even a dangerous index. Dislike may be expressed for work that would be enjoyed if tried.

Many persons express a liking for such professions as banking and teaching. Pressed to explain their preference, if they are honest, they often will admit that they prefer banking because bankers usually appear to be prosperous and because their hours of work are from 10 to three. Their preference for the teaching profession also usually is founded upon some similar reason—often a misconception. For those who would be bankers because of the short hours of business, or teachers because the schools are closed two

## Here's a Way to Test Your Clerical Ability

Af ( )	Jg ( )	If ( )
Bc ( )	Ig ( )	Ge ( )
Jd ( )	Ie ( )	Dc ( )
Bi ( )	Fg ( )	Eh ( )
Li ( )	Di ( )	Aj ( )
Jf ( )	Cg ( )	Ih ( )
Df ( )	Hj ( )	Jj ( )
Ej ( )	Bj ( )	Dg ( )
Ji ( )	Fj ( )	Jh ( )
Ch ( )	Dh ( )	Gg ( )
Ai ( )	Hi ( )	Cf ( )
Fj ( )	Ci ( )	Bh ( )

**O**PPPOSITE each of the combinations of letters above mark the number appearing in the corresponding row and column of the chart at the right. Thus, the number for Af is 6.

Work exactly three minutes. If you can mark down 25 numbers correctly in that time, your score is "excellent." From 15 to 24 numbers in that time gives

	a	b	c	d	e	f	g	h	i	j
A	1	2	3	4	5	6	7	8	9	10
B	11	12	13	14	15	16	17	18	19	20
C	21	22	23	24	25	26	27	28	29	30
D	31	32	33	34	35	36	37	38	39	40
E	41	42	43	44	45	46	47	48	49	50
F	51	52	53	54	55	56	57	58	59	60
G	61	62	63	64	65	66	67	68	69	70
H	71	72	73	74	75	76	77	78	79	80
I	81	82	83	84	85	86	87	88	89	90
J	91	92	93	94	95	96	97	98	99	100

a rating of "average." Less than 15 marked down in three minutes gives a rating of "poor"



days every week and during the whole summer, usually know nothing of the long hours that bank employees labor after the doors are closed to the public, nor of the nights and holidays the teacher spends correcting papers, compiling reports, and attending to other details.

The new science of vocational selection is based on the principle that if a man says he is interested in a certain profession, whether he has had any experience at it or not, certainly he must have looked into it enough to be able to answer simple questions regarding it. If he can, he proves his interest to be more than superficial.

### A Typical Carpenter's Test

If he is considering carpentry, for instance, a set of simple questions like these will test his interest:

1. What tool do you use to drive a nail?
2. What long tool do you use to smooth a rough board?
3. What size hole will a No. 8 auger bit make?
4. What does a "7" on a saw mean?
5. What tool is used to turn a bit in boring a hole?
6. What is the common name for a 20-penny nail?
7. What tool do you use to drive a chisel?

But the amount of general intelligence one possesses determines more than any other single characteristic or any knowledge about a specific thing, what shall be his achievement in life. It is important that one should know whether he is above the average, about the average, or below the average of his fellows in intelligence. Vocational selection furnishes an exact index to the general intelligence of an individual by psychological tests, of which two are illustrated in this article.

The test on page 53 determines aptitude for clerical work, for revealing natural speed and accuracy in handling figures, lines, and letters. The test on this page is an intelligence test to measure the keenness and adaptability of your mind.

But no one should consider that the results of a few tests are conclusive. At the very least a dozen, of varied types, should be taken before one can be reasonably certain that the results represent fairly your mind's capacity. Every corner of the mind must be probed if all its resources are to be revealed.

A reading test is important in indicating academic capacity or ability to progress in any work requiring quick understanding of the written page, in the study of law, engineering, or journalism, for example.

Get an encyclopedia. Select a paragraph at random and read it once. Then have some one read the same paragraph two or three times. Have him ask you questions about it. If he asks you regarding many facts

serve or cannot recall, you are a poor reader. The poor reader cannot succeed in any profession depending on book work.

If the test shows you are a poor reader, and if you are still anxious to undertake such a career, get special coaching on how to read and study. *Learn your difficulties*

### How to Test Concentration

1	17	25	41	7	47	22	50	3
36	60	73	12	69	30	62	53	80
23	48	79	65	78	76	72	46	16
61	77	40	32	2	56	42	24	37
68	51	9	75	15	52	49	33	8
38	10	63	70	29	66	4	57	13
5	11	58	18	55	45	26	43	31
14	27	34	6	21	39	59	19	28
20	44	74	67	71	64	35	54	81

On this chart point to each number in order from 1 to 81. Finishing within 12 minutes scores "excellent." From 12 to 16 minutes is "average." More than 16 minutes is a "poor" record

and then start to overcome them. Textbooks on how to read and how to study can be obtained at any public library.

In order to attack the problem of what you can do, and how you can improve your abilities, take a complete mental inventory of yourself. This inventory should indicate your rating in each of these general tests:

**Ability to read:** Indicating ability in book work.

**General intelligence:** Giving a general idea of ability to achieve success.

**General mechanical ability:** Showing skill in manipulating things as against ideas.

**General clerical ability:** Showing natural aptitude for general clerical work.

**General selling ability:** Showing capacity for success in dealing with people. This is vital to a salesman, minister, or social worker. Consideration must be given also to the fact that diplomacy, rapid thinking, ability to "give-and-take" gracefully, quick decision and the ability to accept criticism impersonally are indispensable concomitants.

The tests I have mentioned furnish only the barest outline of the principles of the new science of vocational selection. They are sufficient, however, to reveal how the principles may be amplified and adjusted to fit almost any trade or profession.

I do not want to be understood as wholly condemning the rolling stone. Changing jobs may sometimes be beneficial, provided you know you are working upward, provided your brain and not your heart directs the change.

### Square Pegs in Round Holes

One of the most prominent clergymen in the United States—a bishop—spent years as a newspaper reporter before he studied for the ministry. He had been fairly successful in the newspaper business, but he realized at last that he had advanced as far as possible and that his future outlook was bleak. Possessing the gift of language and deep religious convictions, he decided to enter the church. His success as a pulpit orator and executive has been remarkable.

There are many such cases of men attaining success after changing vocations. One I remember distinctly. For five years after leaving school the son of a business man of my acquaintance drifted into job after job, none of which he kept for more than a few weeks. Far from upbraiding the boy for his frequent changes of employment, the father encouraged him, though his business associates insisted that he was ruining his son's future prospects by this encouragement. Last year the young man entered the employ of a producer of moving pictures, and there at last found a business that really interested him. He is now secretary to the president and in line for an executive position of greater responsibility.

A recent study of the biographies of men in "Who's Who in America," shows that one out of every five changed the field of his occupation at least once in early life before finding the line of endeavor at which he succeeded.

No matter what your job, it is not the right one if it offers you no chance for promotion, for gaining wider knowledge, for accumulating responsibilities, nor if it saps your physical, intellectual, or moral strength.

These things you can determine for yourself. If you find you are not in the right job, do not be afraid to change. There is ample material in your nearest library to assist you in determining what that change should be.



A scene before an employment agency in New York City. In thousands of cases the men who alternate between unemployment and brief jobs possess special abilities that are never used



# Tools of the Insects

## Nature's Inventions Antedate and Excel those of Man

By Ernest Bade, Ph.D.



**A Brush**—used by ants to clean their feelers

**M**OST of the articles in that great chest of tools that man's inventive genius has contrived through the laborious, inventive ages were invented by the insect world before he fashioned the first. Moreover, his tools are usually inferior in precision and versatility.

For the toolchest of the insects is equipped with the most precise master tools, perfect in material, exquisite in workmanship, unexcelled in utility. Nature attached them to the insects' bodies—to the legs, to the head, to the abdomen, wherever they are needed. They are made of chitin, a material that, unlike the metal tools of man, resists the action of water and the milder acids, breaking down only under concentrated sulphuric, hydrochloric and nitric acids.

Saws, pliers, brushes, augers, hooks, hammers, knives, lancets—all these and yet other tools are in the insect's remarkable chest.

Probably no better example of the master tools of the insect world is furnished than by the saw of the sawfly. Two saws, placed close together, are carried by this insect. The upper part of each saw is braced and the teeth are on the lower side. Under the microscope, each large tooth is seen to be divided into a number of smaller ones. The upper, thickened part of the saw has a hollow groove, and when one saw is protruding, the other is drawn in. With this tool the female fly cuts a depression in a twig for her eggs.

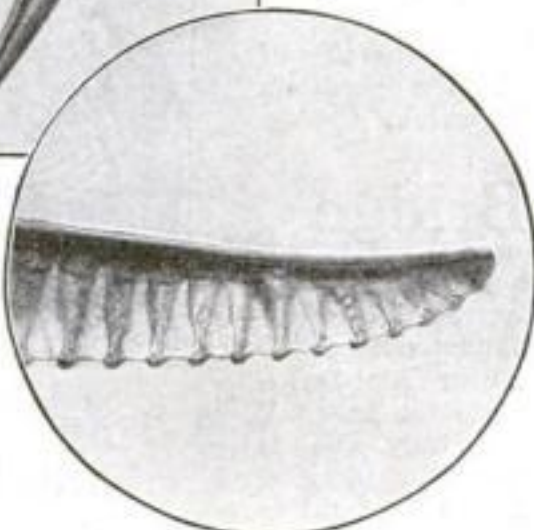
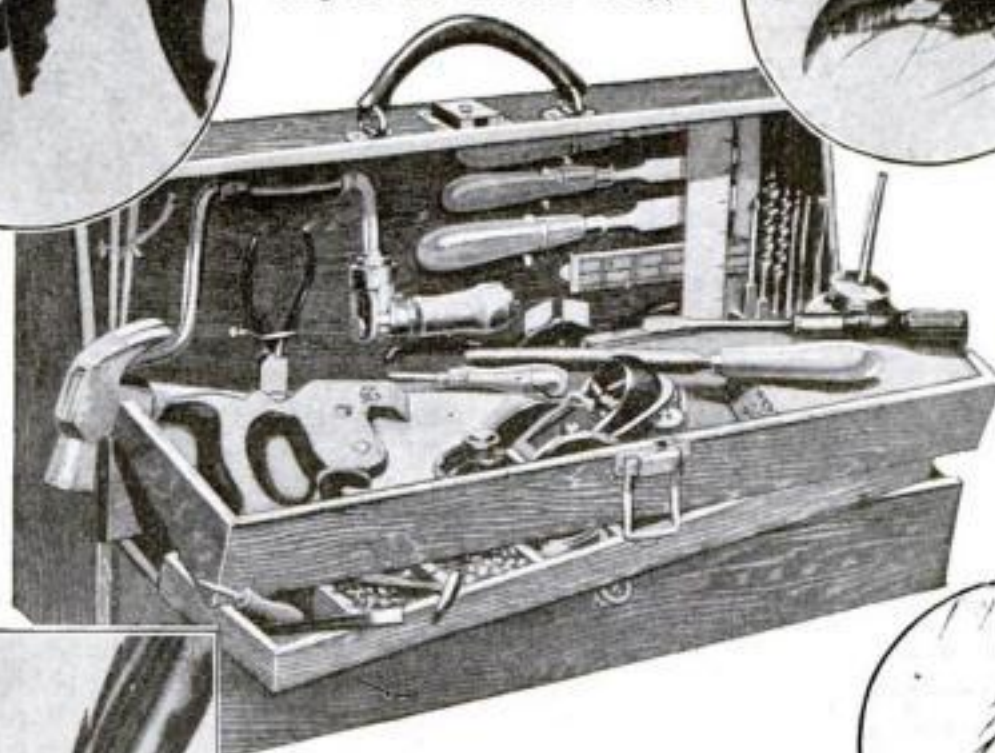
The Rhyssa fly has a particularly formidable "keyhole saw," so strong it can cut hickory. This saw is as elastic as the most finely tempered steel blade and about as thick as a horsehair. The rhyssa is the enemy of wood-boring larvae found in the trunks of trees. By its organs of

sense the rhyssa locates exactly the hiding place of the larvae, and draws forth its saw. For hours the cutting continues, until a larva is reached. The insect deposits its egg then within its victim. Sometimes the saw is driven four inches into tough wood. Withdrawal of the tool is sometimes impossible, becomes wedged in, the insect dying of starvation.

Contrasted to these sawing creatures are the wood-boring insects. The tremex has perfected the art of using a natural auger. The tool, which is as long as the carrier's body, is



Circles above chest. Left: Borer of the pigeon-tailed wasp. Right: Comb on the spider's foot



Rectangle above: The stinging organ of most bees has recurved hooks which prevent its withdrawal by the insect. Circle above: The remarkably efficient saw of the sawfly. Circle at the right: Strong pliers, used by the wheat gall-fly



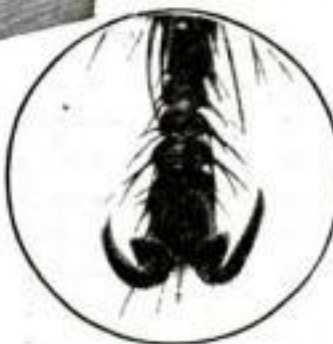
**Pliers**—used by earwigs to adjust wings

rigid, but so elastic that it will return to its original shape after bending. The tip has a sharp point and sharp, inward-curving teeth, and the shaft has a series of depressions. The depressions on the shafts are sharply edged along their entire length, smoothing the hole as they enter. In boring a hole for its egg, the insect lifts its body as high as possible, inserts the tip of the borer, bending its legs as the tool cuts in, until the insect at last is lying flat on the wood.

Stiletos, lancets, and augers are the commonest tools of the insect world. Blood-sucking insects all carry stiletos with which they cut through the tissues of the victims until the blood vessels are bared.

Even the hammer is to be found in nature. The Brazilian beetle (*Passalidae*) carries upon one of the segments of the abdomen

tiny chitin hammers that work upon string-like projections of the same material to produce a continued chirping sound. This beetle lives in runways of wood, and, unlike most other insects, cares for its young, using its hammer and the resultant chirp to call the larvae in the dark tunnels so that they can be fed.



**Grasping hooks**—on feet of the parasitic sheep tick

The earwig is provided with a simple pair of pliers, which it uses for drawing its wings together after flight. When this animal alights, its wings fall unsymmetrically. It draws the wings closer to its short wing-covers, which permits the pliers to grasp the wings and pull them under the covers.

Structures that may be compared only with brushes are to be found on the front feet of beetles and ants. They are hemispherical hollows provided with bristles. A thornlike projection from the lower extremity of the body, likewise covered with bristles, permits the openings to be closed. The brush enables the insect to clean its feelers, which are drawn through the notch for this purpose.

The feet of the spiders are provided with "combs," not, however, for cleanliness, but to enable the insect to climb about its web. These tools also find a use in helping to weave the net.

The insect toolchest is truly complete, one of its wonders being the closeness of the resemblance of the articles it contains to the tools that man has been so long fashioning.

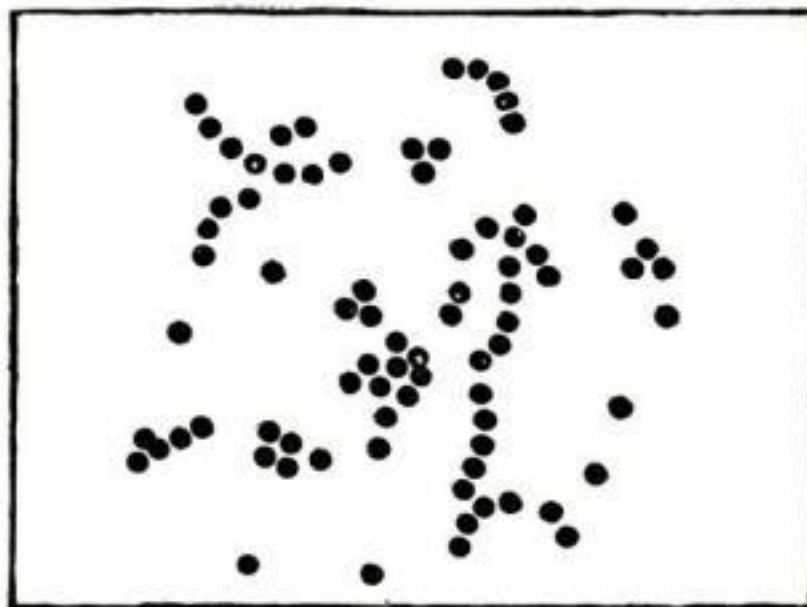


# How Does Your Mind Count Things?

**DO YOU** think in fours when you count irregularly placed objects? If you can do that easily, you have a more mathematical mind than most. Most persons conceive of a group of four only with difficulty.

Many savage peoples use the same word for five and for numbers greater than five. Without reflecting, we do not realize that we, too, think in tiny groups of units. Most persons visualize seven as a group of three and two groups of two. A much smaller number of persons visualize it as groups of four and three. Numbers like 9000 are by most persons conceived as three groups of three units each.

Watch your mind as it counts the dots above, at the right. Note what groupings



Are there 79 spots here?

of units it tends to make. Unless the mind is wary, the confused arrangement will trap its tendency to group anything that is to be counted.



The new wheeled skate, and its inventor, suggesting new stunts

## This Freak Wheeled Skate Creates New Sport

**A NEW** sport is here, "pedcycling," said to combine speed, skill, and thrills in a fascinating blend. Enthusiasts for the new sport claim it will make roller-skating seem drowsy.

To each foot is attached, by straps and clamps, a "skate" consisting of two eight-inch rubber-tired wheels in line with each other. The foot rests upon a comfortable spring platform.

Speeds nearly as great as those possible with ice skates are said to be attainable.

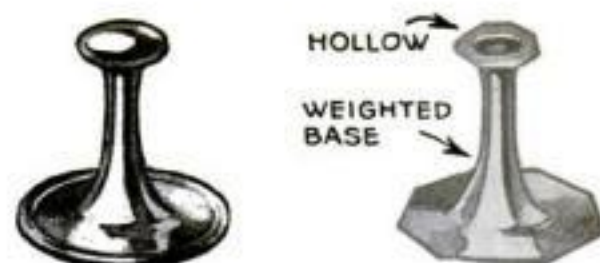
## Combined Watch and Timer without Second-Splitting

**A GOOD** stop-watch is a luxury. Keeping it in condition is expensive. Moreover, it can be used only for timing.

Many amateur games are timed by stop-watches when a less precise watch would be as practical. On the other hand, in tightly contested games an ordinary watch is inadequate.

The combination watch and sports timer here illustrated (which acts as a stop-watch except that it does not split seconds) should meet the timing needs of any amateur games. Besides, it serves as an ordinary watch. It has the usual black dial and also an outer circle of red figures. These latter are used when the watch is timing.

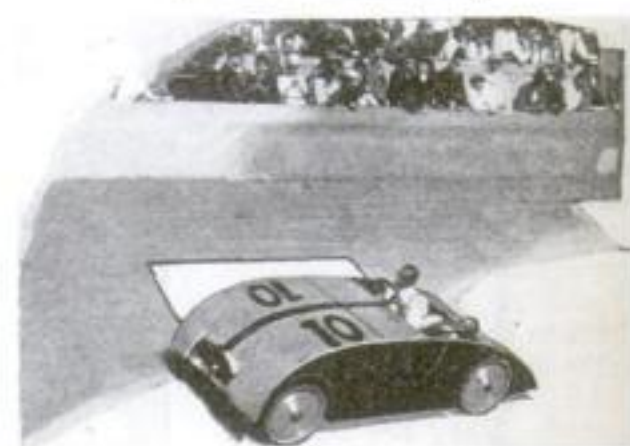
A lever protruding through the side of the watch and controlled by the operator's thumb starts and stops the watch.



## The Roving Collar Button Is Hobbled

**PURSUING** the elusive collar button under the dresser has been an unpopular indoor sport ever since the invention of the boiled shirt. An ingenious Washington man at last offers escape in the form of a collar button that cannot roll. He accomplishes this by supplying his button with a weighted octagonal base.

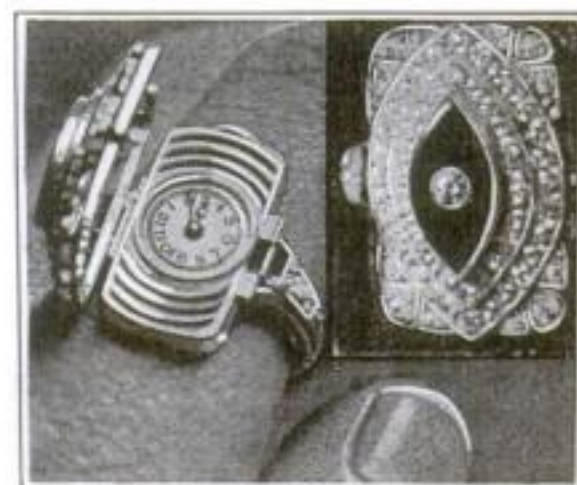
The base of the collar button, being non-circular, cannot roll and the weight keeps it right end up, like the salt and pepper shakers on your table.



## Oddest Automobile Seen at Berlin Races

**IN THE** midst of all the striking sizes, shapes, and colors exhibited by the participants in the recent automobile races at the Berlin stadium, the car above was easily the oddest.

This car is one of the numerous automotive freaks recently turned out by the Koko Works, of Germany. It develops only five horsepower, yet attains considerable speed.



## A Tiny Watch Is Concealed within This Ring

**SO TINY** that it is concealed within a ring and so costly that an expensive automobile could profitably be exchanged for it, is the watch illustrated above. The picture shows its exact size, a half inch across the face and less than one eighth of an inch thick.

A tiny, secret knob releases the ring face, which is incrustated with platinum and diamonds.

The accuracy of the watch has not been sacrificed to its diminutive proportions in any degree.

Copyrighted material

## Curved Arch Built in New Bridge



Showing the curved arch in the Great Western Gateway.

**WHEN** the great Western Gateway, the fine bridge now being completed at Schenectady, N. Y., over the Mohawk River, has crossed the first half from the Schenectady side, it makes a decided turn to the right to meet the approach from the other end. This bend necessitated the construction of what is said to be the first curved bridge arch.

This huge bridge will span 4436 feet and will have cost, when completed in 1924, approximately \$3,000,000.

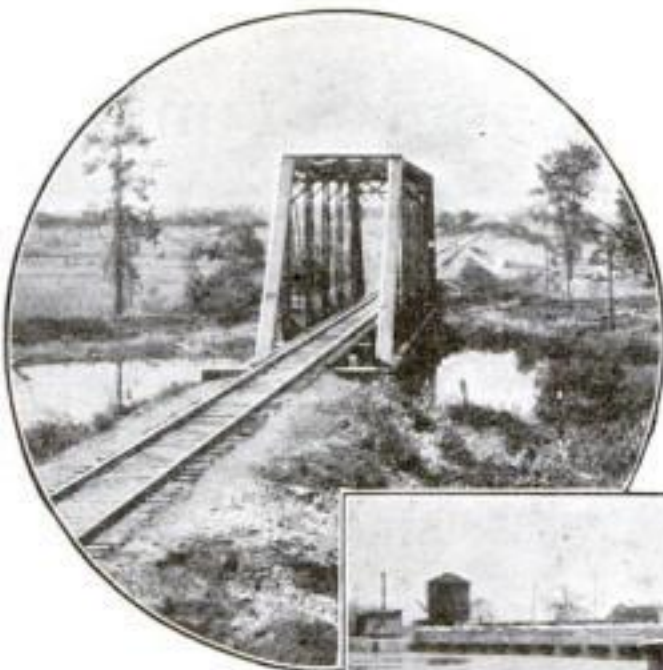


# Bridge-Dam Draws Power from Tiny River

**A**CROSS the Huron River at Flat Rock, Mich., Henry Ford has recently completed a remarkable dam.

Usually where a dam is constructed, a bridge is built just below. To Mr. Ford this seemed a wasteful duplication of construction, so the Flat Rock dam is also a bridge. The Ford railroad crosses it and vehicles also are accommodated. Moreover, the bridge-dam widens the Huron River, making it possible to navigate barges on a stream upon which no craft larger than a rowboat ever before had been seen.

This distinctive piece of construction is the latest step in the prosecution of Mr. Ford's policy of harnessing small streams to generate power for community industries,



At the left: The little stream and the railroad bridge on the dam site as they appeared a year ago. Note the sluggish nature of the stream

supplying employment in agricultural sections during the winter.

The 700 horsepower generated at Flat Rock will operate a factory where bulbs for automobile lights will be made. The power plant will function also as a "booster" station in the power system. This railroad is now being electrified, the main power station being at River Rouge on the outskirts of Detroit. This project is typical of Mr. Ford's power plans. The Rouge River, which passes through his estate at Dearborn, for another example, has been harnessed four times in five miles.



How Henry Ford's bridge-dam project transformed the spot shown in circle



## Larger Cotton Yield Increase Promised by Freak Plant

**B**Y GRAFTING cotton plants to the roots of mulberry trees, P. Dan George, a farmer of La Marque, Texas, has succeeded in producing a cotton plant eight feet tall containing more than 900 bolls. Three mother plants have produced 59 pounds of seed cotton, which, if carried out on a field scale, would result in the extraordinary production of four bales an acre. This Mr. George is attempting to do, and his experiments are being watched with intense interest by cotton growers of the vicinity.

George enjoys considerable reputation as a plant specialist, having developed giant peppers, seedless watermelons and cucumbers, cantaloupes three feet long and other plant curiosities.

## Reclaiming the Sahara

**V**AST areas of the Sahara Desert can be made over into fertile pasture land, a food treasury for Europe's teeming population and limited agricultural areas, according to Gaston Imbeaux, chief engineer of the public works department of the French government.

He asserts that great stores of water underlie the desert and that artesian wells could tap them, as similar water supplies have already been tapped in arid regions of Australia.

## Skilful Dynamiting Raises Old Dam

**N**OT long ago a ticklish situation faced the owners of a large New Hampshire factory. They had recently completed a costly concrete dam, and had laid production plans involving the use of a certain amount of power. This amount, their engineers had calculated, would be furnished them by a dam of just the size they had built. But it was not forthcoming.

A careful survey showed that an unused dam, built more than a half century before, was interfering with the flow of water over the new structure. The engineers had ignored it in their plans, partly because it was only a few yards from the piers of a bridge.

By a delicate piece of engineering, the old dam was dynamited bit by bit without injury to the bridge. The company's dam then began to deliver the necessary power.



Dynamiting the 50-year-old dam a few yards from the bridge

## Generator Hauled across Mountains

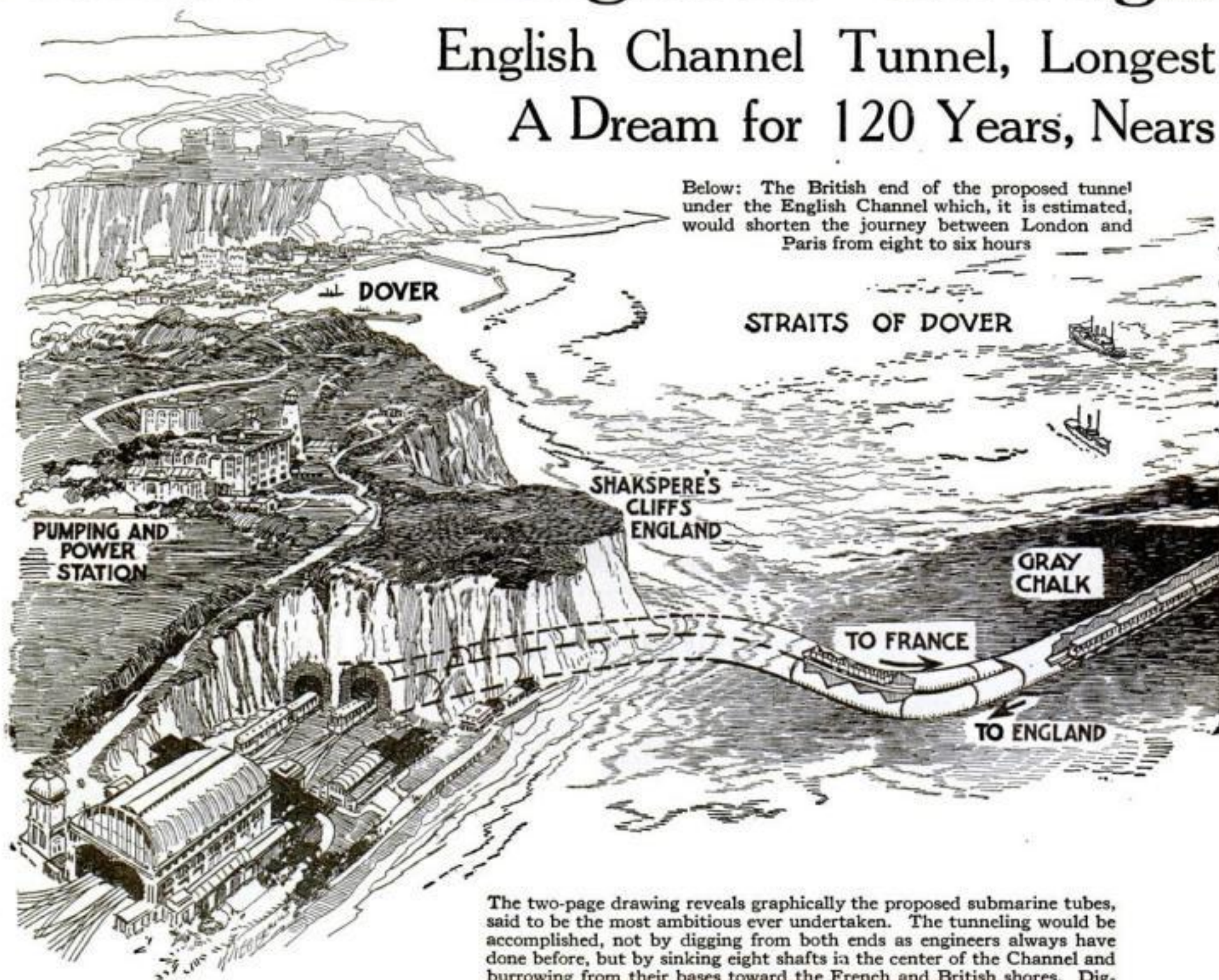


**P**RIMITIVE transportation co-operated with electrical science in this invasion of Chile's mountains. Twenty-four straining horses, a rugged wagon, assisted by blocks and crowbars, gave their best to get this generator to its ultimate destination.



# France to England through English Channel Tunnel, Longest A Dream for 120 Years, Nears

Below: The British end of the proposed tunnel under the English Channel which, it is estimated, would shorten the journey between London and Paris from eight to six hours



The two-page drawing reveals graphically the proposed submarine tubes, said to be the most ambitious ever undertaken. The tunneling would be accomplished, not by digging from both ends as engineers always have done before, but by sinking eight shafts in the center of the Channel and burrowing from their bases toward the French and British shores. Diggings would be lifted out of the shafts and thrown overboard into the sea

## Giant Generator to Equal the Work of 5,557,500 Men

**T**HIS is the stator, or stationary part, of the largest electrical generator ever constructed, one of 87,000 horsepower, being built for the Niagara Falls Power Company by the General Electric Company. A twin generator is shortly to be built for the Commonwealth Edison Company of Chicago. Each of these monster machines, whose size is vividly revealed by the figure of the man standing within the stator, will weigh more than 700 tons and will be 26 feet high and 35 feet in diameter.

Very large numbers often do not impress the human mind as they should. They bewilder its power of conception. But the following statement, made recently by Dr. Charles P. Stein-

metz, recognized as the world's great electrical wizard, conveys penetratingly the tremendous significance of 87,000 horsepower.

"One kilowatt equals 1.34 horsepower, so 60,000 kilowatts represents about 80,000

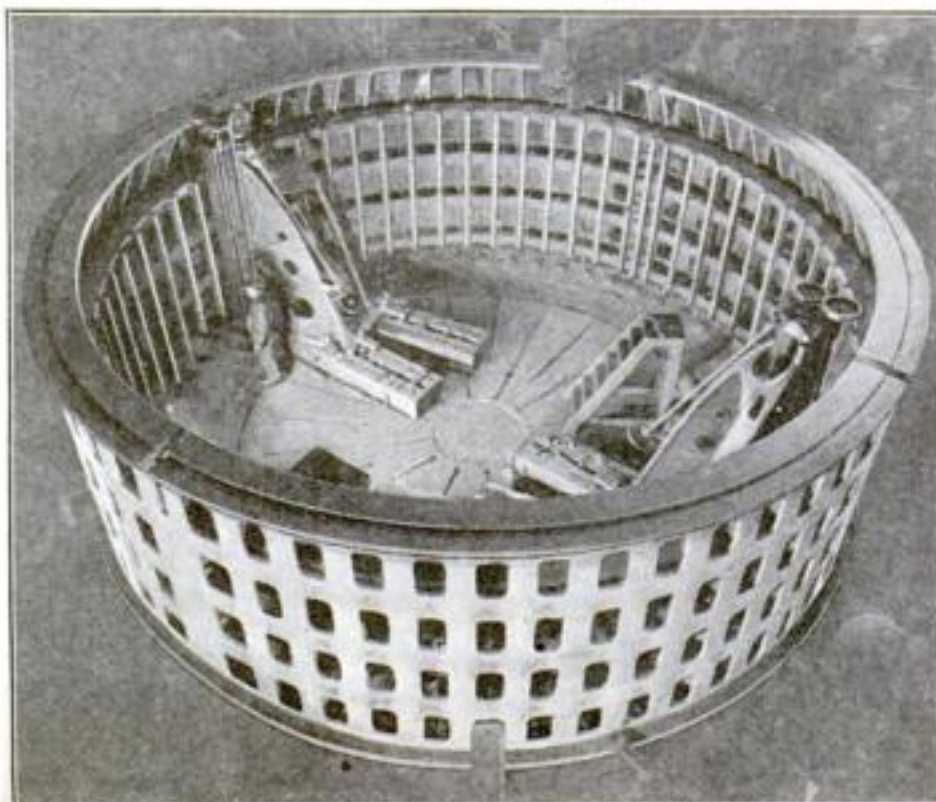
horsepower. Each horsepower is equal to the work of 22½ men, so 80,000 horsepower would be equal to the work of 1,800,000 men.

"But a man cannot work 24 hours a day, while the turbine can and does. Therefore, this giant machine will do the work of three times 1,800,000 men. That is, it will furnish as much energy as 5,400,000 men working in three eight-hour shifts."

This means that the two generators, when completed, could, by joining their enormous energies, equal the muscle power of half the adult male population of the United States.

It should be noted also that Doctor Steinmetz, with the nonchalance inevitable in a scientist who summons and dismisses such incredible energies as only Olympian Zeus ever before commanded, blandly dropped 7000 horsepower from his calculations for the ease of using round numbers. That ignored energy makes each of the generators equal to the work of 5,557,500 men.

These generators do not actually create energy. They merely transform energy of another sort into electricity so that it may be transmitted long distances over wires. The first of these machines will transform the energy of Niagara's falling water; the second, the energy of expanding steam.



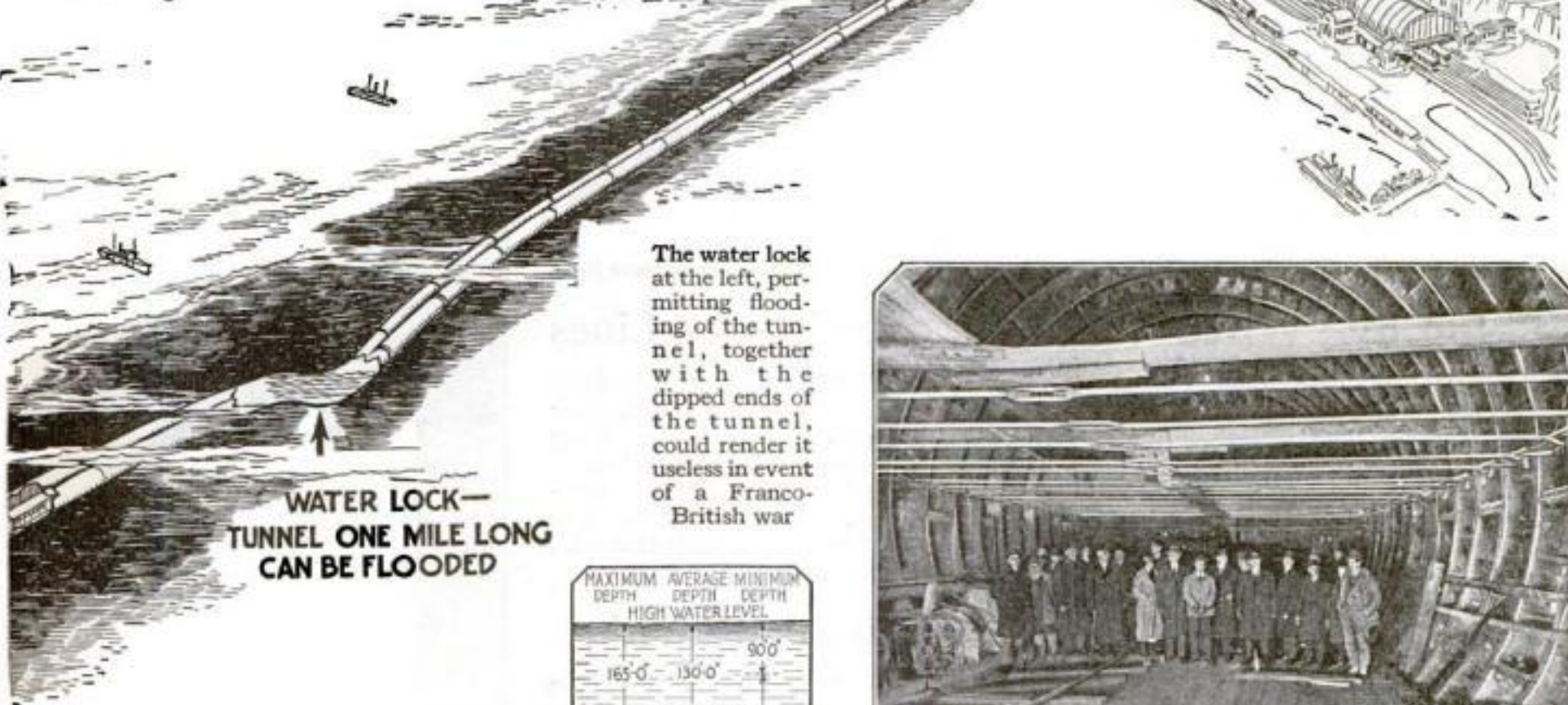
To make Niagara's plunging waters work like a vast army



# 31-Mile Tube

CALAIS,  
FRANCE

under Water,  
Reality

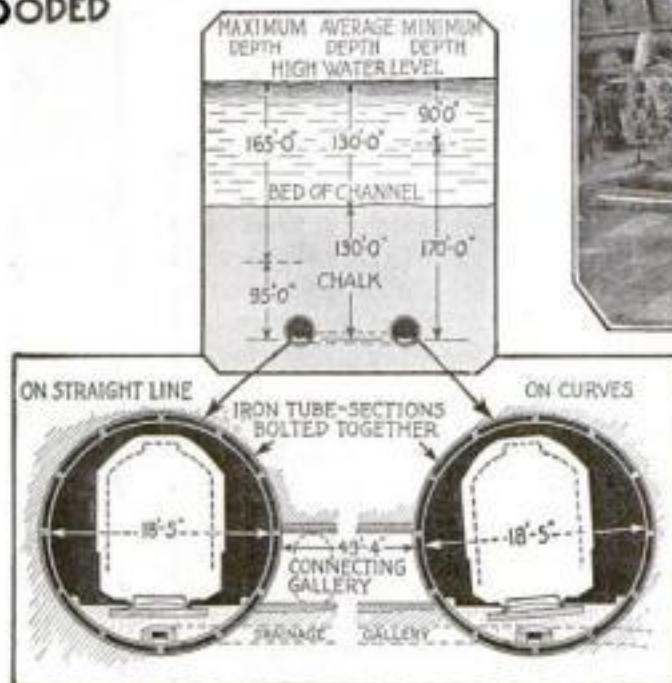


WATER LOCK—  
TUNNEL ONE MILE LONG  
CAN BE FLOODED

The water lock at the left, permitting flooding of the tunnel, together with the dipped ends of the tunnel, could render it useless in event of a Franco-British war



Right: Diagrams illustrating the construction of the two tubes that compose the tunnel, and their position under the Channel. Note also that where the water deepens, the depth of the tunnel lessens. The distance between the tunnel and sea level is thus always about 260 feet, a depth that is deemed amply safe



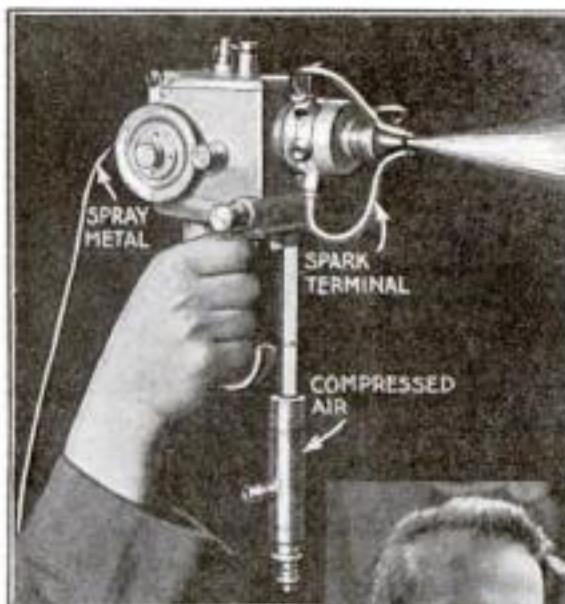
Above: New York and New Jersey officials inspecting the new Hudson River vehicular tunnel. The diameter of this great submarine tube, which is nearly 29 feet, makes it easily the world's largest tunnel.

The proposed Channel tubes, although much smaller in diameter than the Hudson River tunnel, would be many times longer

## Compressed-Air Pistol Sprays Surfaces with Metal

A FURTHER development of the metal spraying pistol, invented several years ago by the Swiss engineer Schoop, is found in the recent reports from the laboratories of this inventor which indicate that he has succeeded in applying adherent and tight metal coatings to such materials as wood, paper, celluloid, and even to explosives.

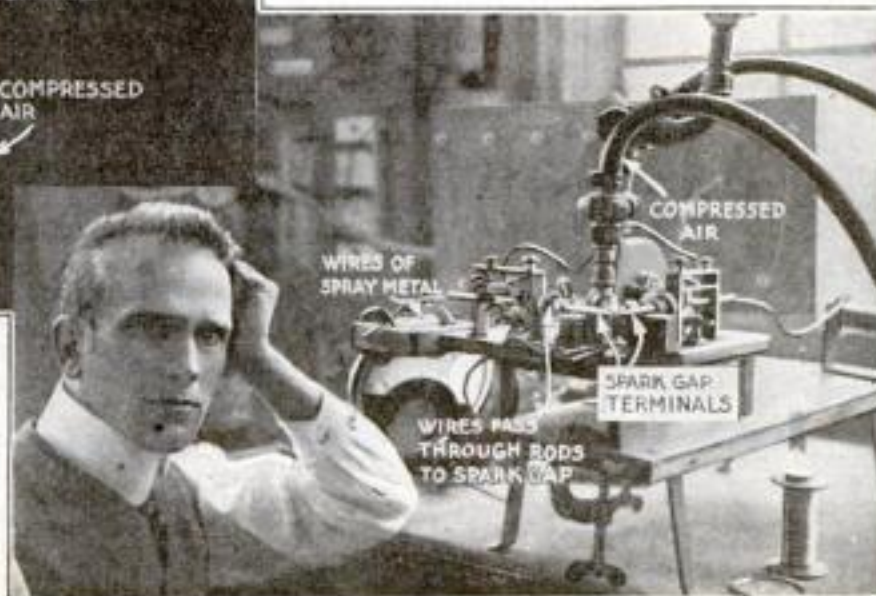
As a result of his first experiments, Schoop sprayed a coat of zinc upon iron so as to make the material rustproof in the same way that galvanizing by the electric process seals up the iron. His method of spraying employs a spraying pistol within which are contained two electric wires that pass through rods to a spark gap. Under a voltage of from 30 to 40, these wires produce a small electric arc that smelts the end of a wire of the spraying material.



Using an electric spark to melt spray metal, and compressed air to blow it onto surfaces, this spray-gun is designed to replace the more usual galvanizing process

Compressed air at a pressure of about 55 pounds a square inch rushes past this molten metal and atomizes it, splitting it into very minute particles. When sprayed against a surface, these particles adhere, forming a coat of metal, the thickness of which depends upon the amount sprayed.

The recent experiments of Schoop have shown the feasibility of spraying other minerals than zinc, such as lead, tin, aluminum, brass, and copper. The fact that his recently improved pistol does not employ oxygen, but only acetylene and compressed air, is said to be an important development, since it materially reduces the cost of operation. The electricity consumed in melting the metals is said to be much less than that used where the material must receive an electrolytic bath.



The spraying pistol, with casing removed to show arrangement of the electric spark and compressed-air mechanism





Receiving and transmitting station for "wired wireless" communication over power lines

## Talking by "Wired Wireless" over Power Lines

**T**ELEPHONING over power transmission lines is now an accomplished fact. Westinghouse engineers recently installed at Battle Creek and at Jackson, Mich., successful stations for two-way communication, with complete transmitting and receiving apparatus at each end.

These installations represent a great ad-

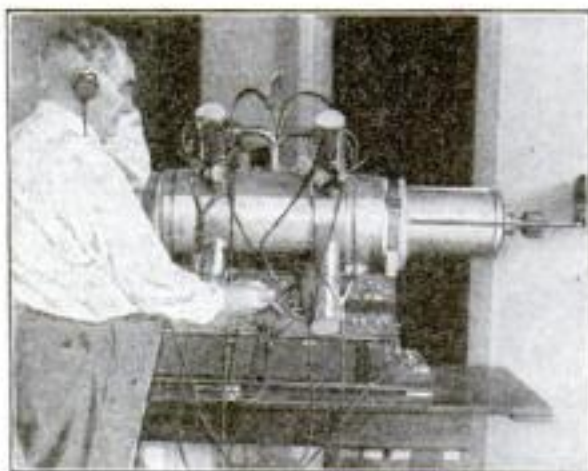
vance in "wired wireless." Others have been merely adaptations of the familiar radio transmitters and receivers. They provided only one-way communication.

The dispatcher's set transmits at frequencies of 50,000 and receives at 60,000. The transmitter at the other station transmits at 60,000 and receives at 50,000.

## New Apparatus Promises to Eliminate Static

**S**TATIC, the electrical nuisance that sometimes mars the audibility of radio and the good nature of operators, now is being attacked by an invention under investigation by the Navy Department, the "clarophone," a device weighing 200 pounds and consisting of 10,240 pieces.

In appearance the apparatus, invented by W. J. Scott, navy electrician, resembles an eight-cylinder airplane motor. Through eight tubes the received signals are carried to the interior, by telephone receivers connected through an amplifying circuit with the receiving apparatus. At the same time the messages



W. J. Scott and his static eliminator

are carried through a specially devised set of circuits that are said to free the signals of static interference. In short, messages are received electrically, not acoustically, and are clarified before they are heard.

Unfortunately, according to the navy investigators, "an enormous amount of amplification is necessary to give a signal equal to the intensity

of one received on the usual receiving set with one tube." But these same men found it the most effective device tested.

The invention promises, when further developed, to make easier communication between airplanes or to noisy buildings.

## Radio Concert Heard in Locked Bank Vault



Radio concert heard inside a bank vault

**L**OCKED inside the four-foot walls of their fire-proof, burglar-proof vault, officials of a bank at Stratford, Conn., heard a radio concert broadcasted from the WJZ station in New York City, 60 miles away.

The entire receiving apparatus, including the aerial, which was of the loop type, was locked in the vault.

The unusual experiment serves to answer the question asked by many radio fans as to whether it was possible for radio waves to penetrate thick walls.

## New York to Europe and Back in Three Minutes

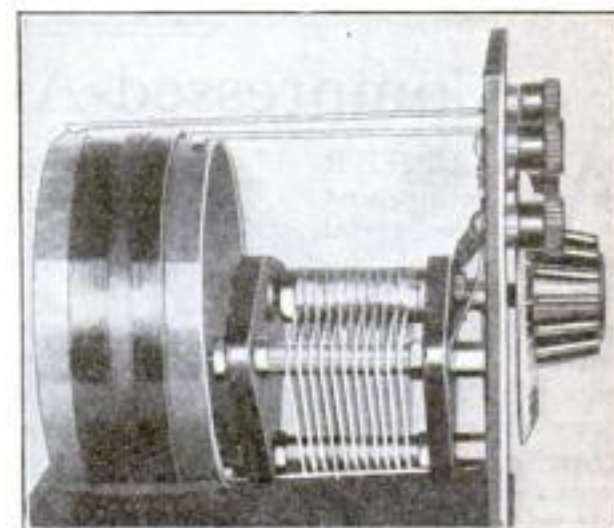
**A** MESSAGE traveling from New York City to Europe and back in three minutes is one of the recently achieved wonders of wireless. The photograph below was taken in the new RCA central station in New York City. From this station messages are sent at such speed directly to London, Paris, and Berlin, by means of the control station at Rocky Point, L. I. The picture shows the receiving apparatus that catches the signals automatically relayed from Rocky Point and transmits them to decoding operators.



Receiving a message at Radio Central

## Interfering Stations Tuned Out by Selector

**T**O AID in tuning out interfering stations, an unusual selector, recently perfected, is equipped with an absorbing



Variable condenser and coil hook-up of the newest model absorbing selector

filter coil that serves to eliminate the broadcasting stations not wanted. This filter is connected in series with the antenna post of the receiving set, and hooked up with the variable condenser.

Undesired stations first are tuned in to greater strength by the selector. The dials on the set then are adjusted to bring in the desired station. By this method, it is claimed, interfering stations, once they are tuned out, cannot be brought in again by manipulation of the dials.

By using one or two selectors in series or in parallel, local stations are said to be eliminated for long-distance work.



# Vacuum Tubes—How to Use Them

By Jack Binns

Radio Editor of POPULAR SCIENCE MONTHLY



This monster 10-tube super-heterodyne receiving set, built by R. R. Mayo, age 19, of New York City (at right), brings in European stations regularly. It is of the same type as

the nine-tube set employed by Paul Godley, of Montclair, N. J., in the first successful reception of amateur signals across the Atlantic, using tubes of the "peanut" or "N" type



**W**ILL signals be increased if I add another B battery to my tube?" How often has the average radio fan asked himself this question? How often has he figured out that logically such a result should be obtained from the increased voltage from an extra battery, only to meet failure when he tried out his logic in practice.

The cause of his failure lies in the fact that he has not taken into consideration the limitations of the vacuum tube. That remarkable little instrument is somewhat like the camel, in that it can be loaded up to a certain point and no further. The last B battery may prove to be as fatal to the tube as was the proverbial straw to the camel's back.

All of this brings us to a consideration of the vacuum tube—its possibilities and limitations.

We can afford to ignore the transmitting tube here, since the average fan is interested almost exclusively in tubes designed for radio reception. There are just two functions for which the receiving tube can be employed—detection and amplification. The conditions governing its use as a detector are practically invariable, irrespective of the type of tube used. In amplification work, on the other hand, the conditions depend upon the frequencies of the currents to be amplified. For general practical purposes these frequencies may be divided into two groups, the first comprising those within the range of human hearing, and the second including all frequencies above hearing. We call the first group audio frequencies, and the second group radio frequencies.

## Hard and Soft Receiving Tubes

It might be well to point out here that there are two main types of receiving tube, one known as "soft" and the other as "hard." The soft tube gets its name from the fact that it is not completely evacuated. It contains a certain quantity of gas that has a most important bearing upon its operation as a detector of radio currents.

From a technical point of view such a tube is the ideal detector, but in practical use its high receptive quality is really its chief disadvantage. In order to get it into its best operating condition, it is necessary to have every circuit about it arranged so that the smallest possible change can be made. This, of course, involves too many control elements for simple operation.

The soft type of tube is limited to detector action, and cannot be used as an amplifier with any degree of success. In fact, there are only two types of this tube available to radio fans in this country—the UV-200 and the C-300.

As a result of the rapid development of broadcasting with its great incentive to production, the manufacture of vacuum tubes has been revolutionized completely. Remarkably efficient tubes, recently produced, give unparalleled results with extremely low power consumption.

A few months ago the possessor of an N tube (the original peanut tube) was the most envied person in radio circles. Now low-power tubes are available to all. The development of these tubes has removed the most serious drawback to home radio by

eliminating the necessity of a storage battery. It has made possible, too, the use of supersensitive receivers at a moderate cost.

While the different types of tubes now available are generally known, the individual qualities of each and the methods by which it may be used most effectively are not so well understood. Let us consider each tube individually.

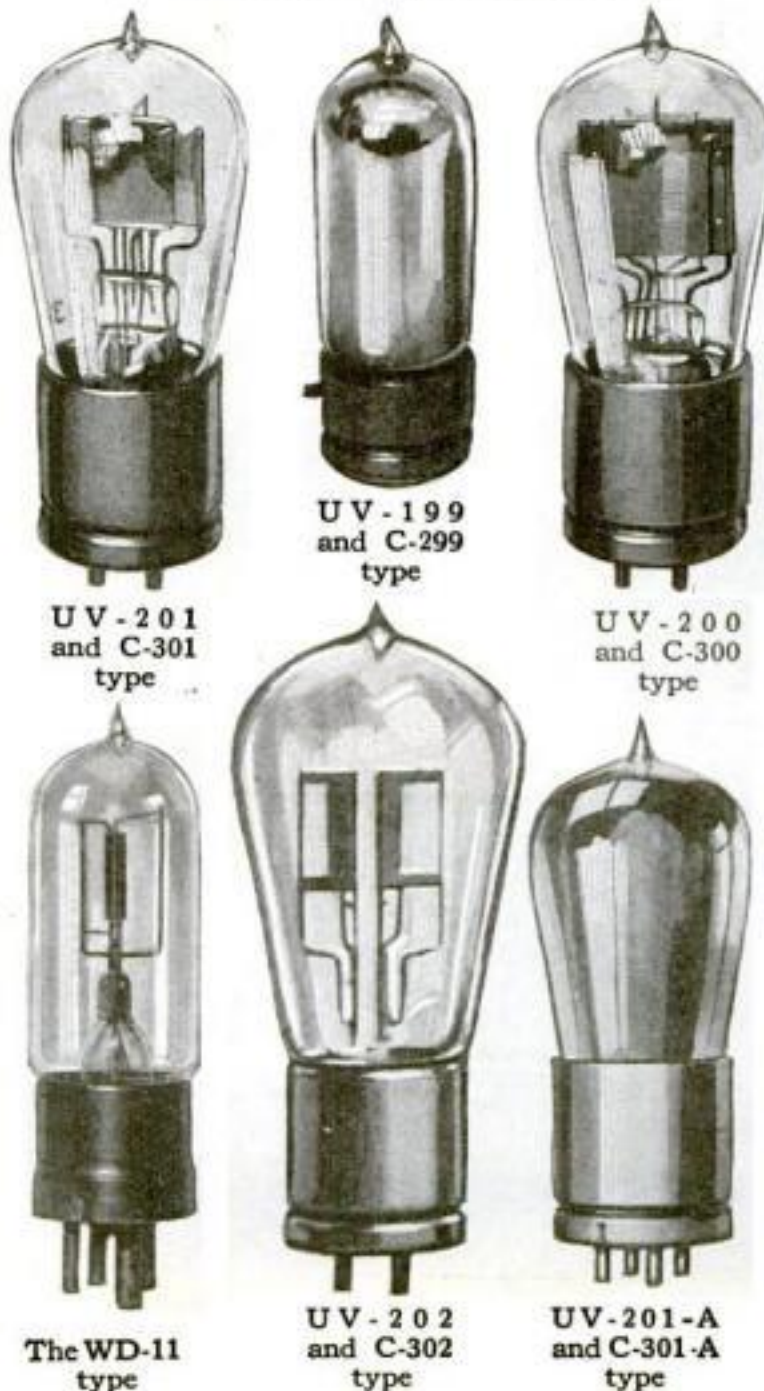
First we have the UV-200 and its companion, the C-300. Each is a soft tube for detector purposes only. For average conditions it operates best with five volts on its filament, and a plate voltage varying between 18 and 22 volts. This requires a storage battery, as well as a variable resistance in series with one lead from the battery, in order to control the voltage and amount of current flowing through the filament. It is necessary also to use a B battery that can be varied. In fact, the best control of the plate current can be obtained through the use of a potentiometer placed across the A battery and then connected in such manner that the negative side of the B battery is joined with the movable arm of the potentiometer. This permits the smallest possible regulation of the current flowing in the plate circuit, and puts the tube in its most sensitive condition, although it introduces another control in the system. In the grid circuit of this tube it is advisable to employ a variable grid leak. The condenser associated with the leak should have an average value of .00025 microfarads.

## Two Types of Hard Tubes

Of all the types of hard tubes, let us consider first the new UV-201-A and C-301-A. This type of tube employs the thoriated tungsten filament, and consumes one quarter of an ampere at five volts. Thus, it is possible to operate the tube from four dry cells in series. This practice, however, is not recommended because of cost, and should not be tried except in single-tube receivers. The best results are obtained from this tube with a storage battery.

In appearance the new tube is somewhat like the old UV-201 and 301, but it has a filament half as long again. This permits construction of a grid and plate assembly of larger dimensions, increasing the output of the tube as an amplifier. It is ideal for use in conjunction with a loudspeaker on the audio side of a receiver. It can be used either as an amplifier or as a

## Six Standard Types of Tubes





detector. In the latter case it is not at all critical, and can be operated with a plate voltage of 45 volts, though in some cases the results will be better with 22 volts. Changes in plate voltage can be made in large steps. As an amplifier it will give clear, distortionless reproduction on the audio side, provided a negative bias is placed on its grid when the plate voltage is more than 45 volts. The tube will stand as high as 100 volts on the plate.

The diagrams on this page show how the grid return to the filament circuit should be connected when the tubes are used as detectors and amplifiers.

The UV-201-A and C-301-A have certain qualities that make them somewhat difficult tubes to use for radio frequency amplification, for they have a tendency to oscillate. The best way to damp out the oscillations is to place a potentiometer across the A battery, and control the grid circuit with the movable arm. When used as amplifiers of radio frequency currents, the tubes should have not more than 45 volts on its plate. Better results may be obtained with even less voltage.

Another storage battery tube is the Western Electric 216-A. This tube is designed solely for audio frequency work, and should not be used for radio frequency amplification, since its internal capacity is too high. It works on a six-volt storage battery, and it is not necessary to employ a controlling rheostat with its filament, which is not at all critical. It will stand as high as 150 volts on its plate circuit; but, as in the case of the UV-201-A, it should have a grid biasing battery.

Now we come to the various types of dry cell tubes, all of which make excellent radio frequency amplifiers because of low internal capacity. They are good detectors and fair audio frequency amplifiers. The original "peanut" tube—the Western Electric N type—is the smallest tube manufactured. It was employed by Paul Godley in the first successful reception of amateur signals across the Atlantic Ocean. In this particular case it was used in a nine-tube super-heterodyne receiver.

The "peanut" tube operates on a filament voltage ranging between .5 and 1.1 volts. It consumes a quarter of an ampere, and consequently can be operated from a single dry cell. It will stand 40 volts on its plate circuit, a value that may be used either for amplification or detection purposes. Due to its small size, the tube will not work well as an audio frequency amplifier, although it can be used successfully for one stage.

In receivers using more than one tube of this type, there should be a dry cell for each tube. The dry cells can be

joined together to form a common battery, but the connection should be a parallel one, not a series. Should the cells be joined in series—that is, positive to negative—the filaments of the tubes would be burned out. This tube, forerunner of all dry cell

ever, is much larger, and therefore is a much better amplifier of audio frequency currents. It can be used readily in conjunction with a loudspeaker. On the audio side of the receiver, it will stand as high as 100 volts on its plate circuit, provided a bias battery is used on the grid.

In amplification the WD-11, the UV-201-A and the C-301-A are approximately the same. Great care must be exercised always in conjunction with the filament voltage.

The latest type of dry cell tubes are the UV-199 and C-299 with thoriated tungsten filaments. These little tubes will operate from a pocket flashlight battery. They are perhaps the best radio frequency amplifiers because their internal capacity is comparatively low. Another point

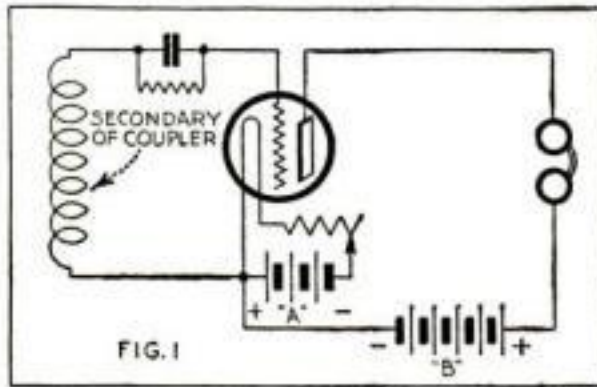
in their favor is the arrangement of the internal leads. The grid and plate leads are opposite each other instead of side by side. This, in conjunction with the fact that they use contact studs instead of prongs, tends to keep the capacity factor low.

On the audio side, the amount of volume that can be obtained from these little tubes is amazing, considering the small amount of initial energy involved in operating their filaments. Great care, however, must be exercised in operating them. Dry cells should be used for the A battery, but in view of the fact that the tubes require 3.1 volts for best operation, two dry cells connected in series are not sufficient. Since it is necessary to use three dry cells joined in series, we are confronted with the question of reducing the voltage from 4.5 (when the cells are new) to 3.1. As a result, the ordinary filament rheostats are not suited for this purpose.

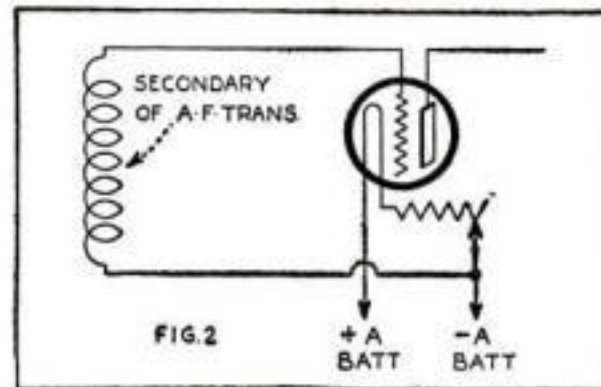
Where a single tube is used, it will be necessary to employ a 30-ohm rheostat. In case two tubes are used, connected in parallel in the circuit, a 20-ohm rheostat in series with the parallel connected filaments will do. For three-tube receivers a 10-ohm rheostat is sufficient. In each case, however, no tube should be removed from its socket while the A battery current is on.

**I**N NEXT month's issue Jack Binns will describe the various types of tuning elements and their uses in radio circuits. He will explain their relative merits with respect to selectivity, ease of operation, and general efficiency. These unusually instructive articles every month by America's most popular writer on radio subjects are designed to help the average fan understand seemingly complicated circuits and to learn their principles of operation. If you are designing your own set, or if you wish to get better results in radio reception, Jack Binns' monthly articles offer sound advice from an expert of long experience.

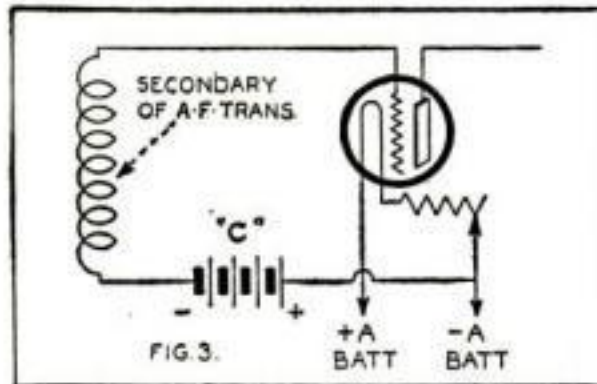
### Grid Return Connections for Three Uses of Tube



When the tube is used as a detector, grid return to filament is connected with positive side of A battery, as indicated in Fig. 1



When the tube is used as an amplifier, grid return to filament is connected with negative side of A battery, as in Fig. 2



When tube is used as amplifier with C battery for grid bias, the grid return is connected with negative of C battery, and the positive terminal of C battery is connected with negative of A battery as illustrated in Fig. 3

tubes, employs the oxid-coated filament.

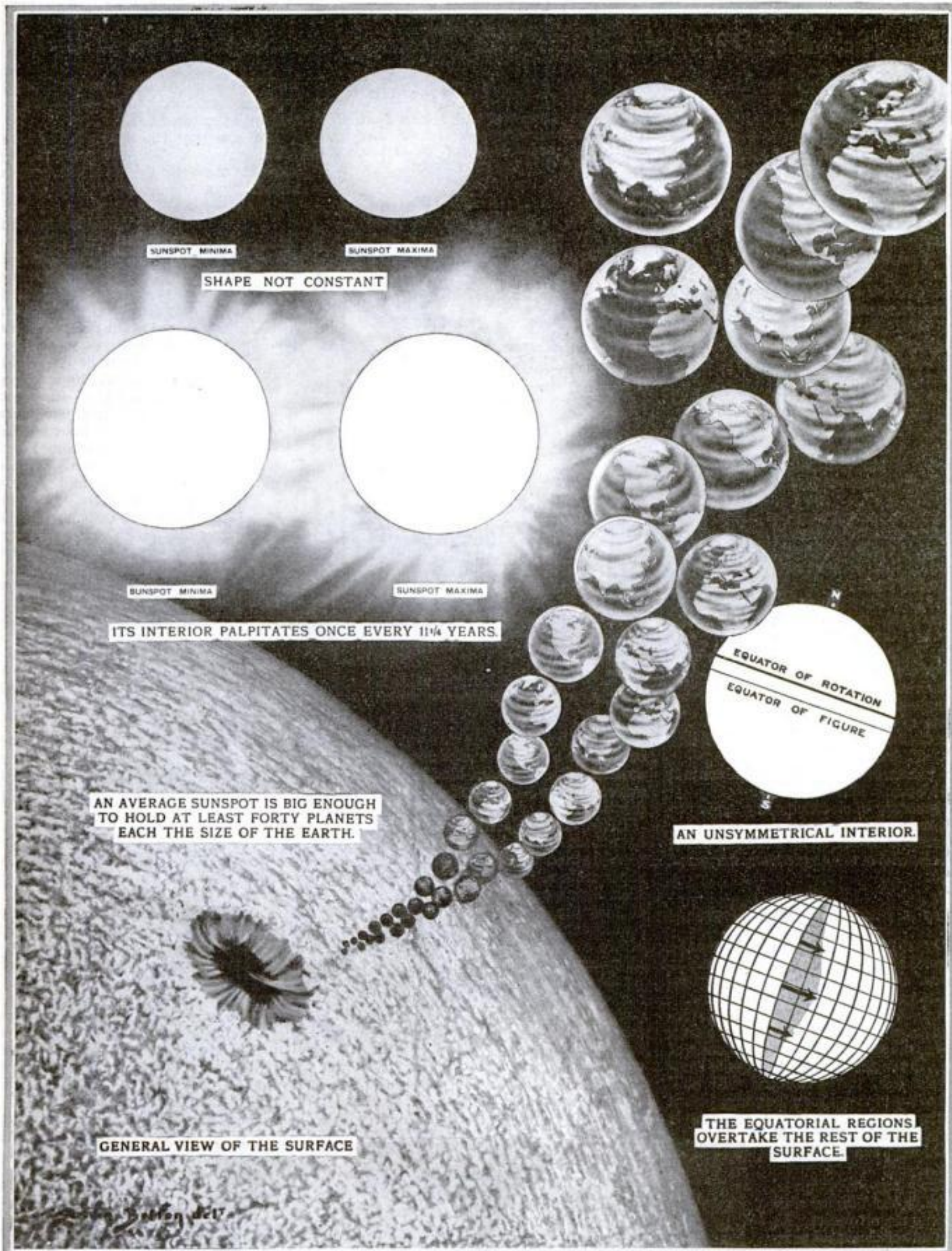
Another tube very similar in physical characteristics is the WD-11, which also is produced with a standard base under the type number WD-12. Operating conditions of these tubes are almost identical with those of the N type so far as their use as amplifiers of radio frequency currents and detectors is concerned. The WD type, how-



Radio music not only increases the honey output of bees, but protects the keeper from being stung, according to John Bilon, a Long Island apiarist, shown above with his bee-taming radio set



# Our Fickle Sun and How It Changes the Earth



Drawn for POPULAR SCIENCE MONTHLY by Scriven Bolton, F.R.A.S. Copyright, Modern Publishing Co., Inc.

**By Scriven Bolton, F.R.A.S.**  
Famous British Astronomer-Artist

**T**HE more we learn about the sun, the more obvious it becomes that our luminary is not the steady light and heat giver it once was believed to be.

A number of the inconstant characteristics of the sun are illustrated above. For example, it has a palpitating interior that causes pulsation of light and heat sufficient to work

marked physical alterations on the earth.

The sunspots—gigantic holes in the incandescent shell of the sun—are found to be cooler areas of the surface. It is significant that when these spots reach their maximum size and number, every  $11\frac{1}{4}$  years, the temperature of the earth's surface area is lowered by about a degree. These cooler periods are accompanied by greater moisture in our atmosphere, and consequently a more abundant growth of vegetation. Sunspots are in-

tense magnetic fields. The electrical discharges often collide with the earth, creating an electrical storm.

Scientific measurements prove that the sun's northern and southern hemispheres are not alike. The activities of the two hemispheres differ. Spots near the equator perform a rotation in less time than those in higher latitudes, actually overtaking the rest of the surface. The observed equator of rotation lies to the north of the equator of figure.



# DANGER—High Voltage!

New Scientific Discoveries Show how Electricity Affects the Human Body

**M**AN-MADE electricity kills twice as many persons in the United States each year as do all the lightning bolts that flash from the sky. Latest available reports show that electric light and power circuits cause nearly one seventieth of all accidental deaths. In every house lighting circuit, in high tension power wires, possible death or injury lurks unseen.

How these accidents may be avoided by a few simple precautions in the home and workshop is revealed by the newest scientific discoveries about the effect of electricity on the human body. Recent researches have proved that the amount of electricity flowing through a 100-watt light bulb commonly used in the home is enough to kill a person—if it passes through the brain or other vital organs of the body.

Yet I have known men to come into contact with tens of thousands of volts, under certain conditions, without suffering bodily injury.

In the past the popular belief has been that electric shocks are due entirely to voltage. Yet science now tells us that while the voltage of an electric circuit may be a contributing cause of death, it is only one of three important factors that determine the hazard of any circuit. They are these:

The pressure of the circuit in contact with the body. This is voltage.

The quantity of electricity flowing in the circuit, measured in amperes.

The resistance offered by the body to the flow of electricity under pressure, measured in ohms.

## Skin Is a Protection from Electricity

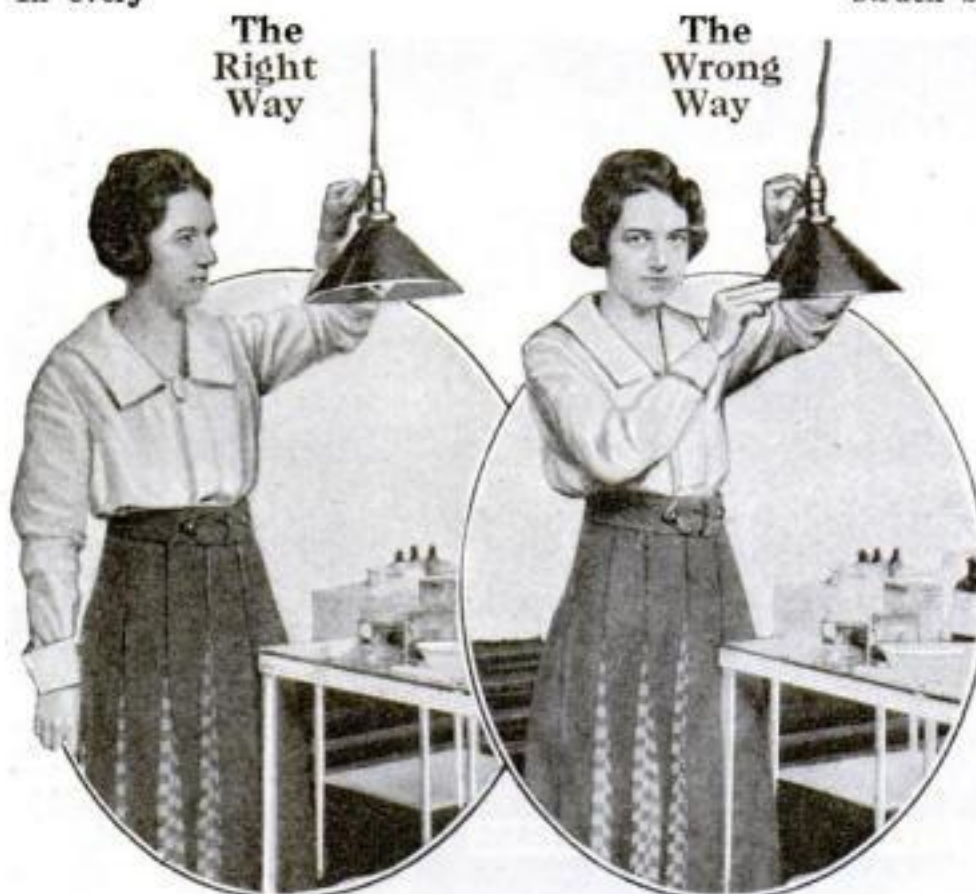
Our greatest protection in resisting the pressure of electric currents is our skin. It serves as a protective armor, highly resistive, to guard us from the deadly flow.

We might compare our skin, in its resistance to electric current, with a heavy piece of cardboard placed over the nozzle of a hose. If the pressure in the hose is comparatively low, the cardboard will hold back the flow of water for a long time before it breaks down. But if the pressure is increased, the water will burst through the cardboard quickly.

Similarly the resistance of our skin to the flow of electricity in a circuit varies with the amount of electrical pressure, or voltage, applied. When the skin is dry, it is a highly resistant insulator. But if it is wet, the current will seep through quickly. Then the blood and muscular tissues, which in the average healthy person contain non-resisting animal salts and liquids, offer excellent paths for the flow of heavy currents even under medium

By George M. Ogle

Associate Member, American Institute of Electrical Engineers and Leading Authority on Effects of Electricity on the Human Body



Use only one hand in switching electric lights on or off. Keep the other hand free from any metallic contact

voltages. In fact, if the skin were severely cut in such a way as to offer direct electrical contact with the main blood arteries, the extremely low voltage of 50 would cause death.

Often, during electrical experiments, men have been heard to brag of their ability to withstand the tortures of an electrical shock from a low voltage circuit far better than their women associates. As a matter of fact the woman receives the greater punishment. This is because the resistance of the average woman's body is considerably less than that of man's. Her hands rarely are calloused; her skin is softer and her general physical condition is more delicate than man's. Any stipulated voltage sends a greater quantity of current through her body.

The resistance of any person varies from time to time, depending on conditions of blood and skin, as well as the amount of moisture or perspiration. A man whose

body is thoroughly dry can stand a higher voltage than he could on a hot day when wet with perspiration.

When a person is subjected to an electrical current under 2000 volts with good contacts the feeling is as if the body were struck by a tremendously powerful blow at all points. In the fraction of a second he is knocked unconscious. The muscles contract and the limbs and features become contorted. If the current is applied for any length of time, the body burns at the points of contact.

At such a voltage the average human body would receive about 10 amperes of current, which, if converted into mechanical power, would be enough to light 800 lamps in the average home!

High powered circuits of 33,000 volts and more will cremate the body beyond recognition within a fraction of a second. Yet, strange to say, there have been cases where the victim, subjected to currents great enough to burn off his limbs, has regained consciousness and survived.

Reports of persons being killed by an ordinary 110-volt lighting circuit are numerous. Investigation of most of these cases, however, reveals that death was due to a defect in

the wiring, permitting a high voltage current to enter into the supposed 110-volt household circuit, or that the victim died from some physical defect aggravated by the electrical shock.

## Practise These Safety Rules

The house circuit usually is protected by numerous electrical devices to prevent high tension circuits from entering the home in the event of an electrical breakdown between high and low voltage circuits. Yet there have been cases where these devices have failed. The following safety rules can be practised easily in any home:

1. Use only one hand (preferably the right hand) in switching electric lights on or off. Keep the other hand free from any metallic contact that may form a return or ground conductor.

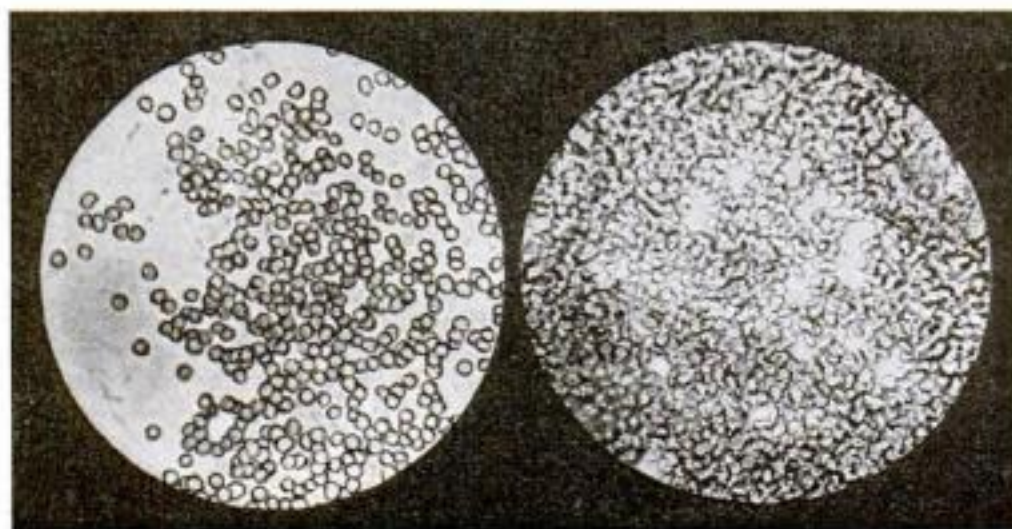
2. Never switch an electric light with one hand while the other hand is in the water or on the faucet of a kitchen sink or wash-stand.

3. Never operate an electric light while standing in a bathtub or shower bath.

4. Always be sure that the body and hands are dry when operating electrical devices.

5. Never tamper with electrical circuits with which you are not entirely familiar.

Observance of these rules may save your life.



Typical blood corpuscles of a normal, healthy person

How blood corpuscles disintegrate after electrocution

**I**N AN early issue—A fascinating article describing the machine invented in France to extract electricity from the air for commercial use.



# More Household Ease, Safety, and Efficiency



Sanitary pitcher made from a milkcan. Spout and handle are joined by an encircling spring. Piercer enters spout to make hole



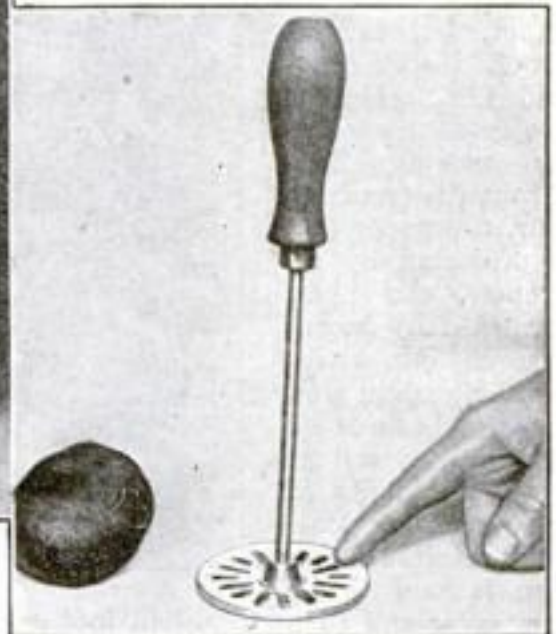
This wooden holder for hot handles can be transferred easily from one handle to another. A simple spring attachment slides on and off handle



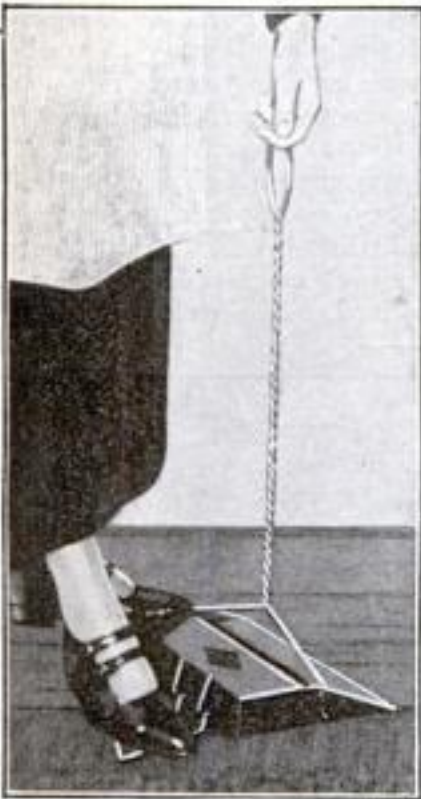
This gas range folds back against the wall. When thus collapsed, it extends only seven inches. It has four full-size burners and a 25½-inch top. A valve shuts off the gas when the range is folded back



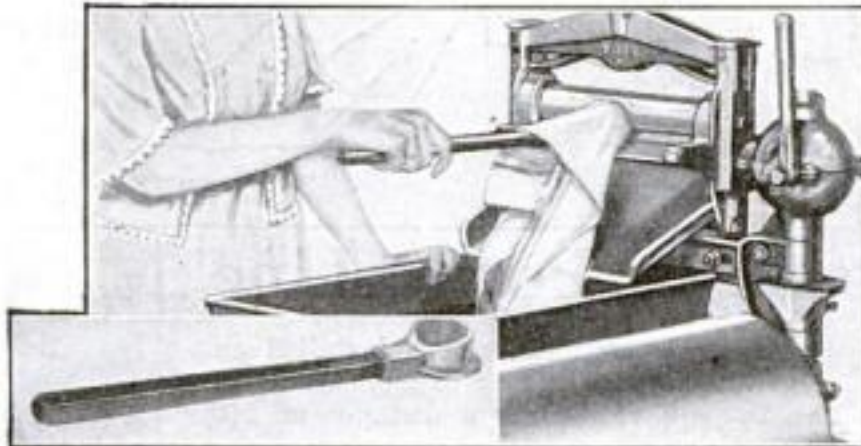
This simple suction cup grips a fruit jar cover powerfully. Both hands are left free to twist the obstinate cover from the jar



Even small lumps are not spared by this relentless aluminum potato masher. It is claimed not to require scraping in cleaning



This pan obviates stooping and a foot lever will hold it against the floor



Squeezed fingers and scalded hands are said to be prevented by this clothes lifting stick



More than a score of branching rubber fingers on this mop attack germs and grease in odd corners of jugs and cooking utensils. A moment's flushing with water cleanses it for future use



Without leaving this sifter, flour may be sifted any number of times. When one sifting is completed, turn it upside down. Each end of the sifter has a lid



Baby's milk can be warmed in the nursery or anywhere about the house with this handy electric warmer



This combined wringer and washboard attaches to any ordinary set or portable tubs with a galvanized iron tray and flexible wire clip. The rollers furnish a 112-pound pressure



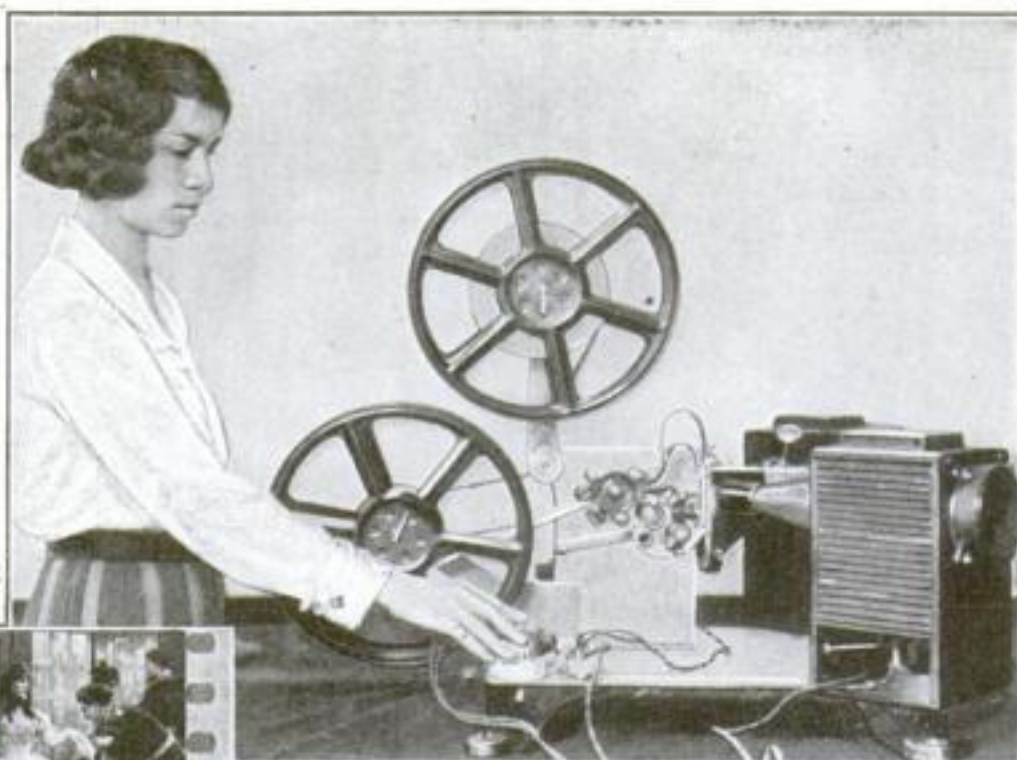
# Home Movies with New Paper Film

**M**OTION pictures are made generally available for the home, the classroom, and the church and for similar uses by the invention in England of a fireproof paper film and a projecting machine that may be operated by any one.

The film is of standard size, permitting reproduction from any negative, and can be made so cheaply that the American distributors say they will be able to sell it outright for less than the rental price of celluloid film. It is sensitized like ordinary photographic printing paper, but is fireproof. Unlike celluloid film, which is projected on a screen by passing light through it from the rear, the paper film is projected by reflection, the light, furnished by incandescent lamps instead of carbon arcs, being directed against its surface from both sides of the projecting lens. The resultant picture is said to be very clear and to fill an eight-foot screen.

A unique feature of the apparatus is that it may be used as a giant microscope. Any object of a size capable of being placed within the opening through which the film passes in projection may be thrown on the screen in natural color and full detail, magnified 2500 areas.

The manufacturers claim many points of

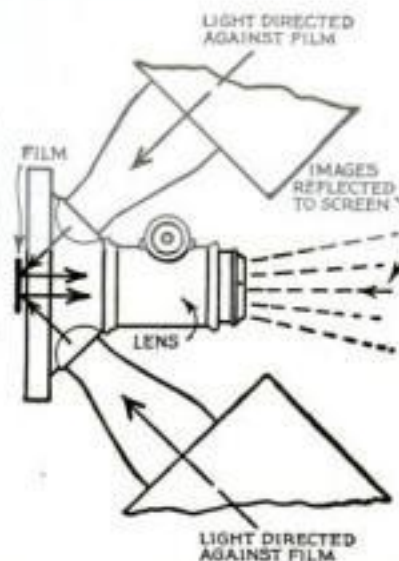


Courtesy Harry Levey Service Corp.

Left: A section of the new paper film, suggesting with what completeness of detail the invention reproduces a scene. Above: The projecting machine, showing reflectors and the course of the film



Right: A diagram showing how reflected light makes possible the use of opaque film. Ordinary motion picture film is penetrated by light from behind in projection



advantage for paper film over celluloid film, especially since it is designed entirely for non-theatrical use by amateur operators. It is more durable, they assert, and will not crack or tear so readily as celluloid. Again, the design of the projector is said to make it unlikely that the film will be damaged when being shown. Standard motion-picture machines turn the reels for projection by means of sprocket wheels that revolve through perforations in the sides of the film. The paper film, however, passes behind the lens on a roller, a sprocket being employed in the mechanism merely as a guide. Moreover, the picture surface of the paper film cannot be scratched, since it has no contact with any metal part. If the rear of the film is scratched, it is not evident on the screen, as is the case with celluloid film.

Since there is no open light and since the film is non-inflammable, the apparatus needs no fireproof booth, and requires no additional fire insurance premiums. The film may be sent through the mails in ordinary paper wrappings.

The projector is portable, weighing about 35 pounds. It may be packed into a small carrying case. The usual domestic electric current suffices for its operation. Operation is simple, any normal person being capable, it is said, of operating it after reading a few simple directions. The projector sells at about one third the price of the standard machines.

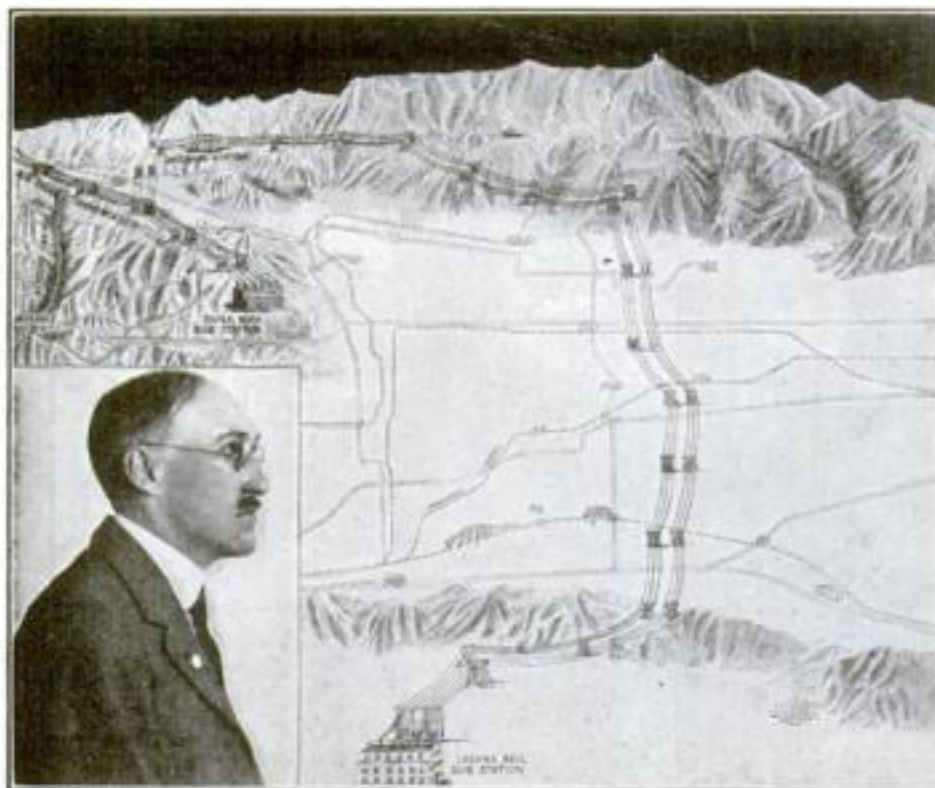
## The Longest and Strongest Power Line

**T**HE first considerable step toward the utilization of the tremendous water power resources of this country, which, as was told in the July issue of POPULAR SCIENCE MONTHLY, have been wasting their vast energies for years, has been taken by the Southern California Edison Com-

pany. This corporation has installed an electric transmission line capable of carrying 220,000 volts over a distance of 240 miles.

The route of the line, the longest and highest voltage transmission line in the world, is shown on the accompanying map.

More than two years' research work was necessary for the solution of the problems involved in thus enormously increasing the power of the lines, which formerly operated at 150,000 volts. More than a year was required to reconstruct them so that they could carry this record load. The lines connect the Big Creek power plant and the city of Los Angeles. Their conversion to the 220,000-volt capacity was accomplished under the direction of H. A. Barre, executive engineer of the Edison Company, who is shown in the insert.



The new California power line and its creator, H. A. Barre



## Noise Photography Achieved, Claims British Inventor

**"P**HOTOGRAPHING noise" sounds like a slip of the tongue. But the British inventor of the supersensitive camera shown above claims that it will accomplish that remarkable feat. He asserts that noise causes rings of air to be formed and that these are capturable by photography sufficiently delicate.

Not content with creating a scientific toy, he has set his sharp-eyed contrivance to analyzing the noises made by the exhausts of automobile engines, working on the theory that such sounds reveal unerringly the flaws in motor performance.

It is only within the realm of simple sounds that the camera is claimed to be effective. Its results with complex sound combinations are said to be valueless.





### Sewing Machine Spotlight Saves the Eyes

A POCKET flashlamp, adjustably attached to the frame of the sewing machine and focused on the needle, not only adds to convenience in sewing, but saves the eyes of the operator in threading the needle or in guiding the work.

### Handy Typewriter Eraser Can Be Renewed



The eraser holder and its parts

THIS new design of interchangeable typewriter eraser, offered by a Pittsburgh, Pa., manufacturer, permits longer use of the eraser and greater economy.

A set of erasers of the familiar circular type is provided, but, instead of being mounted permanently on a metal center, there is a separate holder to which a new eraser may be fitted when the old one wears out. By removal of the holder, the last fragments of an old eraser may be used. The holder is equipped with a brush.

A GORGEOUS "flower" show at the bottom of the sea, where strange plantlike animals rival in beauty the choicest blooms of our gardens and greenhouses, will be described in next month's POPULAR SCIENCE MONTHLY, with wonderful photographs that will amaze you.

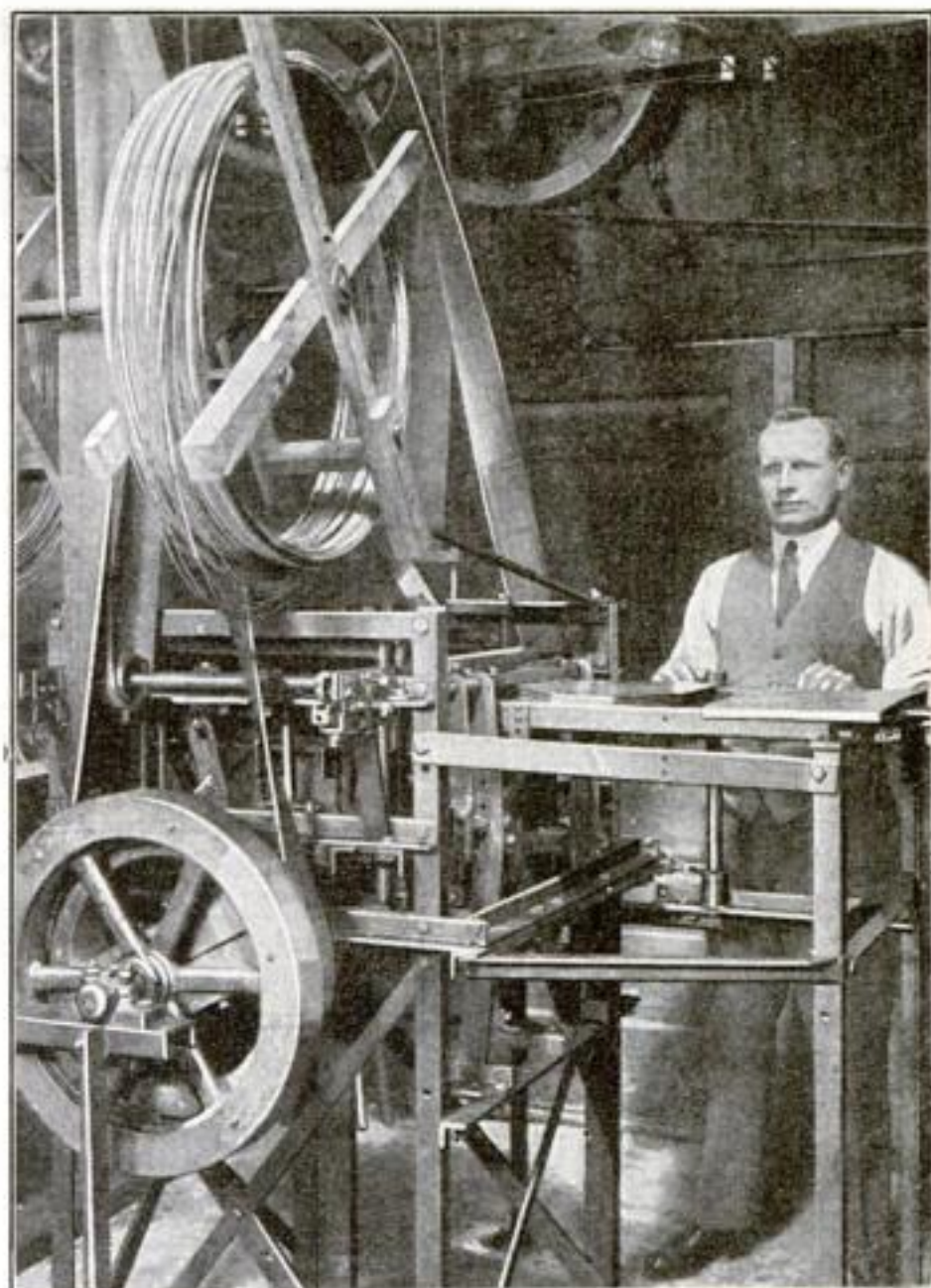
Also in the same issue, a remarkable article on how divers, armed with spears, plumb the ooze of the ocean bottom for treasures hidden in the bones of a sunken ship.

## Turns Out 35 Kitchen Pans a Minute

SIXTY-NINE distinct claims for patents are made by W. J. Roepke, of Los Angeles, automobile and aviation engineer, for a high-speed pan-making machine that he recently perfected. This machine is said to turn out in one minute 35 finished one-piece pans of tin, aluminum, or sheet iron in any desired size or shape. It also is said to be the first new process offered the pan-making industry since 1867. Most manufacturers still employ the old punch and die method.

The Roepke machine, electrically driven, selects a sheet of metal from a pile, bends it, presses it, binds its edges with wire, and produces a finished pan with each revolution of its camshaft. Octagonal sheets of metal are used as shown in the illustration.

The steel arms of the machine take the topmost sheet, fold down ends and sides, fold the corner against the ends, bend the edges outward to receive the wire binding, take wire from the two rolls, bending each length around half the pan's circumference, roll the metal over the wire, bind it tightly and, finally, eject the finished product at the rear of the machine.



W. J. Roepke, of Los Angeles, and his pan-making machine

Different sized pans are made by changing the forms and folding mechanism. The machines themselves may be made larger or smaller, according to the needs of the users.

Mr. Roepke took two years to invent and perfect this wonderful machine.



### Improved Shovel with Step Saves Worker's Feet

EVEN the common dirt shovel is capable of improvement. A new type, recently patented, is said to embody two distinct advances in shovel manufacture—a several-purpose step that saves the worker's shoeleather, and a phenomenally resistant metal.

The step adds stiffness and strength, making the blade safely usable as a crowbar in small jobs. It also prevents cracking along the line where the front strap is welded to the blade, usually the fatal center of shovel collapse.

The step saves not only wear on the shoes, but also the strain on the arches of the foot, often caused by the long continued contact with the sharp upper edge of the blade. The special steel of which the shovel is constructed is said not to curl at the edges, and to wear unusually long.

### Changing Tires Made Easy by Rim Fastener

PUTTING on the tube and shoe of an auto tire is made an easy task by a simple attachment that also prevents the rim from springing. It consists of a metal fastener bolted across the joint of the rim, holding it rigid and in line.

A special tool, when inserted in the fastener, permits the rim to be adjusted easily for changing the tire.

When the tool is removed, the fastener causes the rim to spring back in place.



Adjusting rim with tool shown above





A record (reduced) of the word "America," made by the oscillograph. Although the utterance of the word required less than a second, the reproduction of its vibrations is more than three feet long. Note how the vibrations in the syllables merge.

# The Great American Voice

## Fitting 13,000,000 Telephones to 110,000,000 Talkers

By R. W. King

Editor of the "Bell System Technical Journal"

**T**HE telephone in your home is built scientifically to fit your voice.

This may surprise you at first thought since your telephone looks exactly like every other telephone. Indeed, it is like every other telephone. In no other industry, not even in the automobile industry, has the standardization of parts been carried farther than in the making of telephone apparatus. And yet the telephone is designed scientifically to fit your individual voice.

Fitting the telephone to your voice is a different proposition than fitting shoes to your feet or a hat to your head. When you purchase a pair of shoes or a hat, you get them because they conform in size and shape to your feet or head. Making a fit of this sort is a relatively simple matter, for it involves merely the selection of the one right hat for you, or of the one right pair of shoes. But fitting a telephone means designing a delicate instrument that will adapt itself not only to your individual voice, but at the same time to every other voice. In other words, it means fitting an entire telephone system to every human voice.

In spite of this fact, the fitting has been accomplished successfully through experiments carried on in the laboratories of the American Telephone and Telegraph Company and Western Electric Company, the results of which recently were announced. Now, while you may have to try on a half dozen pairs of shoes to find the right ones, you can take up any telephone and know that it will serve you as well as any other telephone in the entire system.

And what are the results of these investigations by the telephone engineer in his laboratory?

### Telephone Questions and Answers

Among other things, an exhaustive study of the properties of human speech has put the telephone engineers in a position to answer questions that at some time or other must have vexed every person who ever has put a telephone receiver to his ear.

Why does the girl in the central office habitually say "thr-r-ree"?

Why is it that some people can be understood easily over the telephone, while others can not?

Why do familiar voices—often those of intimate friends or members of our own

families—sound different over the telephone than in face-to-face conversation?

The qualities in which all voices are similar can be understood best by observing how the telephone engineer studies the amazing intricacy of human speech.

Speech, as nearly every one knows, con-

sists of four syllables, each syllable being different from each of the others. If you observe a little more closely as you pronounce the word, you notice that the syllables merge into one another, not by quick jumps, but by a sort of blending which consists of a rapid series of very small changes. Observing even more closely, you probably will note that the sounds of the syllables themselves change gradually from beginning to end.

The telephone engineer, however, does not trust to the more or less haphazard evidence of his ears. Through delicate scientific instruments he has learned that when we speak the word "America," an extremely complicated train of sound issues from our vocal cords, to be caught by the ears of our listeners. In his laboratory he has a contrivance called the "oscillograph," an instrument that literally permits him to see the sounds of the human voice. By this instrument, speech may be visualized and a permanent record made of the sound vibrations of which speech is composed.

Sounds uttered into the transmitter at one side of the oscillograph are carried by connecting wires to a large spindle at the center, where they are recorded photographically on a film. The picture across the top of these pages is an oscillograph record of the sound waves that make up the word "America." But even this record, although it looks extremely complicated, is in reality considerably simplified by the omission of the more rapid waves of the voice. The omission is intentional, for the particular oscillograph used was incapable of recording vibrations above about 2000 a second. Had another type of oscillograph been employed, vibrations of the voice extending up to about 5000 a second would have been photographed. However, after glancing at the very complex record of a single word, we can appreciate the remarkable wizardry of the ear, which receives literally millions of these rapid vibrations and synthesizes them into intelligible speech.

### All Voices Are Similar

Records of the oscillograph have demonstrated conclusively the similarity of all voices. Records of the word "America," if made by a hundred different voices, would appear substantially the same, because the movements by which the organs of articulation produce the sounds making up the word are the same for all speakers, and would produce in the air sound waves of the same frequency of vibration.

**I**N THE United States there are 13,329,379 telephones—64 per cent of the total number in the world, according to statistics recently compiled by the Bell Telephone System.

The engineers who maintain this vast number of instruments as an efficient working system have just made some surprising announcements as a result of their research work.

They say that all voices, male or female, harsh or soft, young or old, no matter how they may sound to our ears, actually are alike, in the sound vibrations they produce.

They tell why some people can be understood over the telephone, while others cannot.

They explain why we cannot recognize familiar voices over the phone.

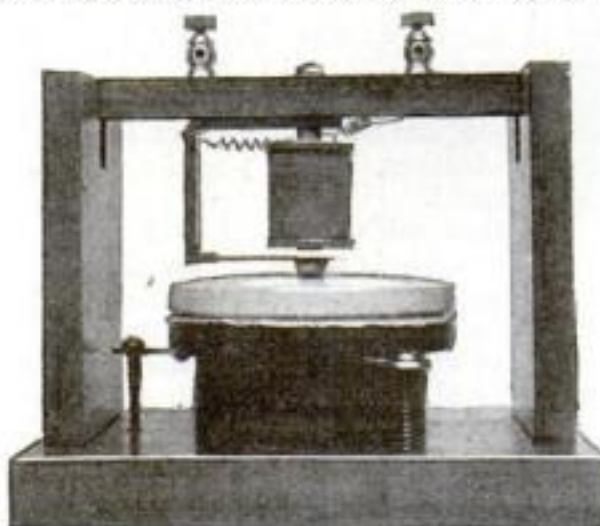
They let us see the sound of our voices.

They tell us why the Central girl says "thr-r-ree," and they answer other similar questions that every telephone user wants to know.

Read these fascinating new facts about your phone and your voice!

sists of sound waves or vibrations in the air. The vibrations receive their impulse from air released from the lungs through the vocal cords. Their character and form are regulated by the organs of articulation—the tongue, the roof of the mouth, the teeth, the lips.

Suppose you say the word "America." You recognize at once that it consists of



Courtesy Western Electric Co.

Alexander Graham Bell's first telephone instrument of 1875, from which our modern telephone system has grown



CA



The personal equation, of course, cannot be entirely disregarded. Different habits of articulation—the slurred speech of one man, or the distinct, careful enunciation of another, or a difference in the volume of sound produced by the various speakers, due to their different manner of speaking—would cause the records to differ to a greater or less degree in intensity, but the frequency of vibration would be the same in all.

As a result of thousands of observations upon speech sounds made by means of the oscillograph it has been found that the higher frequencies of the voice—of which we are not conscious as we listen to speech, and which make up not more than five or 10 per cent of the total energy of speech sounds—contribute enormously to the intelligibility of those sounds.

It has been found that sounds such as *th*, *f*, *r*, *s*, and *z*, are the most difficult to understand because they depend upon very high frequencies. Some frequencies of *th*, *f* and *r* exceed 5000 a second, which is about the maximum frequency of human voice waves. This fact explains, among other things, Central's fondness for rolling her *r*'s when she pronounces the word "three." In her training for telephone work she has been instructed that the *th* sound is difficult to hear over the wire and must be accented if it is to be understood.

### Central's Rolled R's

In the operator's effort to speak the difficult *th* sound intelligibly, she usually puts so much stress upon it that it becomes something like "thuh," and this causes her to make two syllables of the word "three." Her natural inclination after pronouncing the syllable "thuh" is to give the *r* a roll. Try it yourself and then you will see how it works.

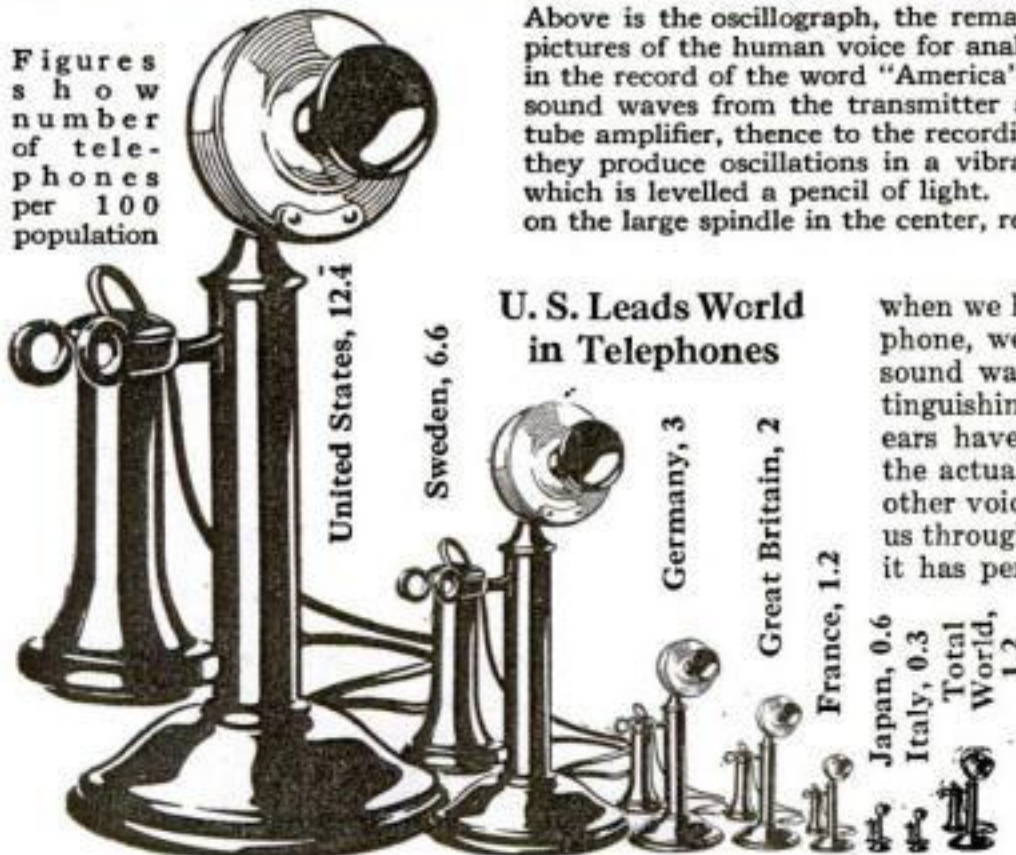
The difficulty of carrying the sounds mentioned above over the telephone line also explains the difficulties experienced by a person who lisps or has some other impediment in his speech that prevents him from uttering those sounds distinctly when he attempts to make himself understood over the telephone.

In the list of sounds that are easy to understand is the word "four." The operator rarely requests the telephone user to repeat when he calls a number including a four, and yet this word contains a sound that is especially difficult of transmission—*f*. The reason for this is that the long *o* sound in the word is one that can be interpreted correctly almost every time it is spoken over a telephone.

Long *e* is another sound which is easily understood over the telephone. So is *l*. Names designating telephone exchanges first must be words made up of sounds that carry readily over the wires and that differ from one another, particularly in their consonant sounds; indication of their geographical locations is of secondary importance.

Two numbers that are quite easily con-

Figures show number of telephones per 100 population



### U. S. Leads World in Telephones

fused when spoken over the telephone are "five" and "nine." Each word is characterized by the long *i* sound, which is very easily transmitted. The differentiation between the two words hinges on certain subtle differences in the consonant sounds that are difficult to transmit. It is for this reason that the exchange operator is taught to differentiate between them by pronouncing "nine" in two syllables, thus—"ni-yen."

### Why Telephone Voices Are Different

The reason familiar voices are frequently unrecognizable over the telephone is that the modern commercial telephone apparatus does not transmit all the frequencies of the voice. Experiments with the apparatus already described have taught the telephone engineer that certain voice frequencies may be filtered out of a telephone line without loss of intelligibility. Since the telephone is a commercial proposition and manufacturing costs must be kept as low as efficiency will permit, the commercial telephone is designed to carry only those frequencies that have been found necessary to intelligibility. In consequence,

when we hear a friend's voice over the telephone, we may hear it stripped of certain sound waves that usually give it the distinguishing characteristics to which our ears have been accustomed when hearing the actual voice. In other words, it is another voice, a changed voice, that comes to us through the telephone receiver, although it has personality and can be readily distinguished from other voices.

For experimental purposes in the laboratory, perfect telephones have been made. That is, they carry all waves of the voice and preserve all the refinements and individual characteristics of intonation and inflection. The commercial telephone, however, does not have to meet this very high requirement. If it transmits speech intelligibly, the loss of minor inflections is of little consequence.

To refine telephone apparatus to the point where it would transmit speech, not only intelligibly, but with perfect fidelity as to inflection, would make telephone service so expensive that nobody could afford it. There would be no more point to such refinement of telephone apparatus than there would be to the use of only chemically pure salt and sugar in the kitchen where the commercial grades are quite good enough and the chemically pure articles might cost thousands of times as much.

**H**OW to supply and circulate an abundance of fresh air in inclosed buildings where large crowds of people gather has been one of the pressing health problems of modern life. Read, in an early issue, how science is finding a solution by the invention of remarkable indoor "weather making" apparatus.



## "Lawn Mower" Cuts River Weeds

A "LAWN MOWER" for weedy lakes, rivers, and ponds is a recent addition to the fleet of nautical oddities that man's ingenuity has launched. It is said to accomplish in one day the work of hundreds of scythes.

Under normal conditions its makers claim

away the underwater base of a bank and would clog with weeds. The operation of the boat and cutters is controlled by a very few levers, so that it needs only two men.



Above: The simple controls to be manipulated. Left: The paddle propellers, which act also as a rudder, turning the launch around nearly in its own length

There are two operating arms, each with two limber, serrated knives. A shoe at the point where the knives meet the operating arm enables the cutters to ride over ordinary obstructions. Even extraordinary obstructions rarely damage the knives seriously, because of their flexibility.

The angle at which the knives are placed permits free clearance of the weeds.

The makers of the cutting launch declare that they have found no water weed able to resist it.

it will cut as much as five acres an hour.

The mower consists of a shallow draft, flat-bottom hull, somewhat resembling an ordinary motor launch. The propeller, which is also the rudder, is of the paddle type. A screw propeller would tend to wash

## Passing Autos Are Counted by Box of Springs

THE apparatus illustrated below automatically registers the number of automobiles passing over a road. It was devised by a ranger of the United States Forest Service for use in the national forests.

A steel box is sunk in the road with its lid flush with the surface. The lid is supported by six coil springs, each capable of bearing a weight of 400 pounds.

The lid is a lever with its fulcrum 18 inches from a post in which is inserted a rod. This rod is pressed upward as the wheel of an automobile passes over the lid.

A registering device is operated when the lid springs back into place as the weight of the automobile is removed. Each pair of wheels registers, the number of vehicles passing being half the number shown on the register. The apparatus has registered an automobile traveling at 55 miles an hour.



Above: A ranger inspecting the U. S. Forest Service auto tallying device. Left: Tallying a passing machine



Left: The all-in-one tool-chest closed

Right: Revealing the drawers and compartments



## Every Tool Has Its Place in This Chest

PRACTICALLY every tool a mechanic requires is said to find a place in this recently invented chest. Ingenious advantage of each cubic inch of space is taken to accomplish this end.

Small tools are carried in drawers and large ones in a specially contrived section. The case is said to be arranged to carry 100 pounds of tools. It opens and closes like a suitcase, and is carried like one. The material is vulcanized fiber, and self-raising traps and combination drop fronts are provided to help it withstand rigorous usage.

## Tractor Drivers Are Protected from Fumes by Muffler

HEALTH and efficiency are protected, it is claimed, by this new tractor muffler. It is designed to keep from the lungs of the drivers the carbon monoxide fumes with which exhaust gas from gasoline engines is laden. The dangers of these fumes were described in the September issue of POPULAR SCIENCE MONTHLY.

The muffler is attached to the exhaust manifold directly, and is equipped with a deflector that throws the gases forward. By thus directing them, the device prevents them from striking the ground and raising dust.

It will be noticed that the long exhaust pipe is eliminated by this appliance. The makers claim, however, that this has no bad effects on muffler or power.



## Planes Attack Mosquitoes

ATTACKING mosquitoes with airplanes seems, offhand, like stalking germs with a club. But in Alsace-Lorraine, where the breeding places of these insects are being spread with oil by low-flying planes, strikingly successful results are claimed.

That part of France, because of its hundreds of marshes, used to suffer from annual hordes of these notorious pests. It long has been known that oil prevented such breeding, but the problem of spreading it in the inaccessible inner parts of the marshes seemed insurmountable, until some one thought of airplanes.

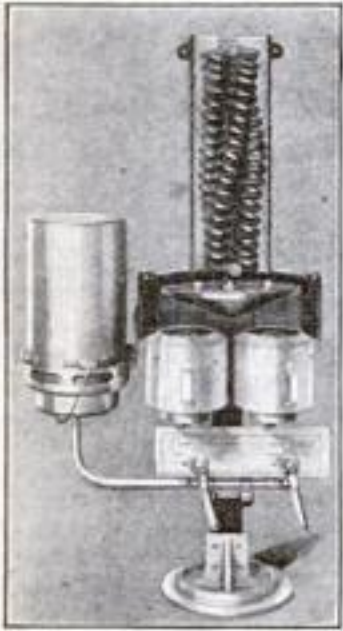


## Economical Water Heater Burns Kerosene

**B**ANISHMENT of all condensation troubles and a coil arrangement that applies maximum heat to the coil surface are advantages claimed for this new kerosene-burning water heater. Attached to a boiler, it supplies running hot water to every part of a house.

Condensed water vapor is taken care of by the preheater head, a top-shaped attachment at the bottom of the coils. Its upper surface slopes toward openings that convey drippings from the coils over the edge and down to the tapering point of the head, whence they drop between the burners into a cup.

The exaggerated twist shown in each of the four coils is designed to trap all the heat.



The heater with casing removed

## What to Read in Science

*A Résumé of Recent Publications*

**E**STIMATING the Cost of Buildings, by Arthur W. Joslin, U. P. C. Book Company, New York. Revised edition of the writer's earlier work on this subject. A comprehensive handbook of building construction. Illustrated.

**W**HAT to Eat in Health and Disease, by Benjamin Harrow, Ph.D., Associate in Physiological Chemistry, College of Physicians and Surgeons, Columbia University. Dutton & Co. A non-technical but scientific guide for those who want to know what to eat and why. Illustrated.

**A**MANUAL of Artificial Respiration, by Capt. G. R. G. Fisher. The Stratford Co., Boston, Mass. A handbook of first aid treatment, describing means to be used in reviving victims of drowning, asphyxiation, shocks, sunstroke, poison, freezing, and blows. Illustrated.

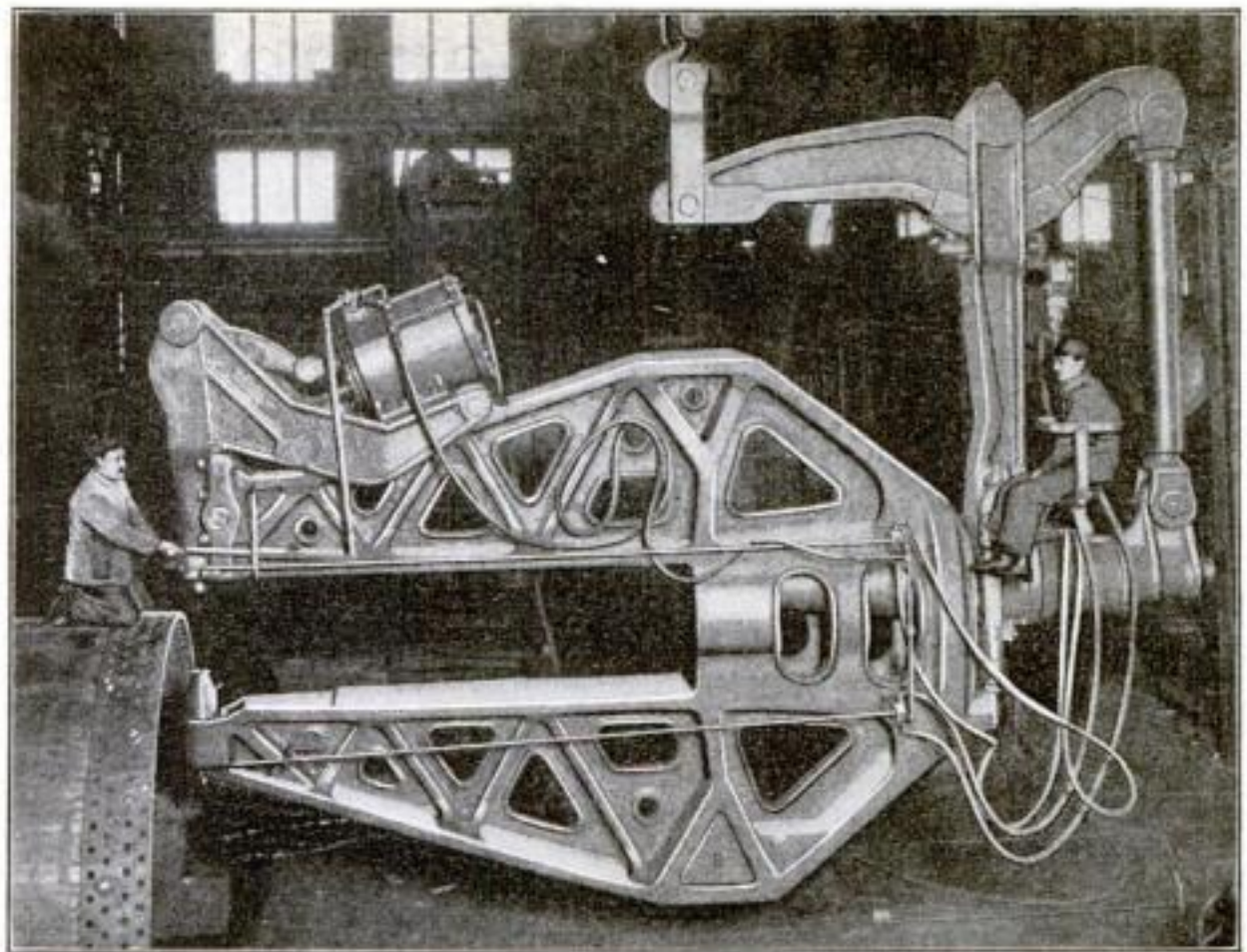
**S**MITH'S College Chemistry, revised and rewritten by James Kendall, Professor of Chemistry, Columbia University. The Century Company. Illustrated.

**R**ADIO Receiving for Beginners, by Rhey T. Snodgrass and Victor F. Camp, A. I. R. E. The Macmillan Company. A short cut to mastery of the international Morse code. Illustrated.

## Fix Your Own Plumbing

**A**PPROACHING winter brings to every household the bugbear of frozen pipes and cracked plumbing fixtures. Why not be prepared?

In an article next month an expert will tell just how you can repair your own plumbing. Whether you own your own home or not, you will find it profitable to read what he says.



## Largest Riveter Weighs 150 Tons

**T**HE largest portable pneumatic riveter ever made, weighing 150 tons, has just been completed by a Chicago engineering company for use in the water power development at Niagara Falls.

This giant machine is to be used in riveting steel plates of the volute or spiral casing and penstock, or water gates, of a 70,000-horsepower hydraulic turbine. The greatest distance across the volute is 48 feet and the diameter of the water entrance is 15 feet, the plates varying in thickness from  $1\frac{1}{4}$  inches to  $\frac{7}{8}$  of an inch.

The volute and penstock must be built to withstand a water pressure of 110 pounds to the square inch. Because of their immense size and weight, a portable riveter of long reach and capable of developing tremendous pressure was necessary. The huge machine designed has a reach of 118 inches, a gap of 30 inches, and exerts a force of 300,000 pounds. A shock absorber is incorporated in the drive.

The riveter is to be moved from place to place by means of a huge crane, and tilted and rotated by motors.



## Quick Shave or Massage with New Vibrator

**O**NLY 30 seconds for a clean shave or an electric massage with the same speed and with the same instrument. Both are made possible by the invention of an electrically operated safety razor and vibrator that will be placed on the market soon by a Connecticut concern.

An electric coil inside the handle, which may be operated on any house circuit, causes the blade to oscillate with imperceptible swiftness as the razor passes over the face. The result is that the hairs of the beard are removed as though by a tiny saw, not chopped off as in the ordinary operation of shaving. Shaving with the new razor is said to cause not the slightest discomfort, no matter how tender the skin or heavy the beard.

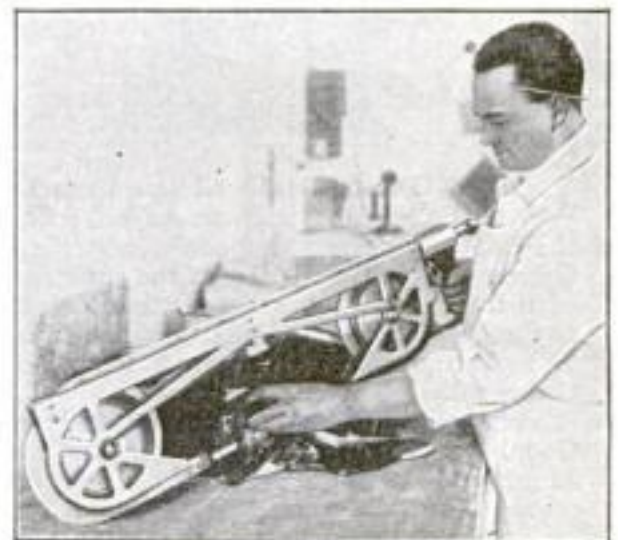
The same coil that operates the razor also moves the vibrator when the contrivance is used for massage.

## Motor-Driven Meat Saw Saves Butcher's Time

**A** PORTLAND, Ore., inventor has perfected a new type of power-driven bandsaw for use in meat-handling and selling establishments. It operates on a frame resembling somewhat the usual hand meat saw.

Power is supplied to the device by a flexible shaft, or directly by an electric motor mounted on the saw frame. A trigger on the handle controls the speed of the saw. The entire machine weighs less than 14 pounds, and can be used for any meat- or bone-cutting job, from cutting steaks to slitting beeves.

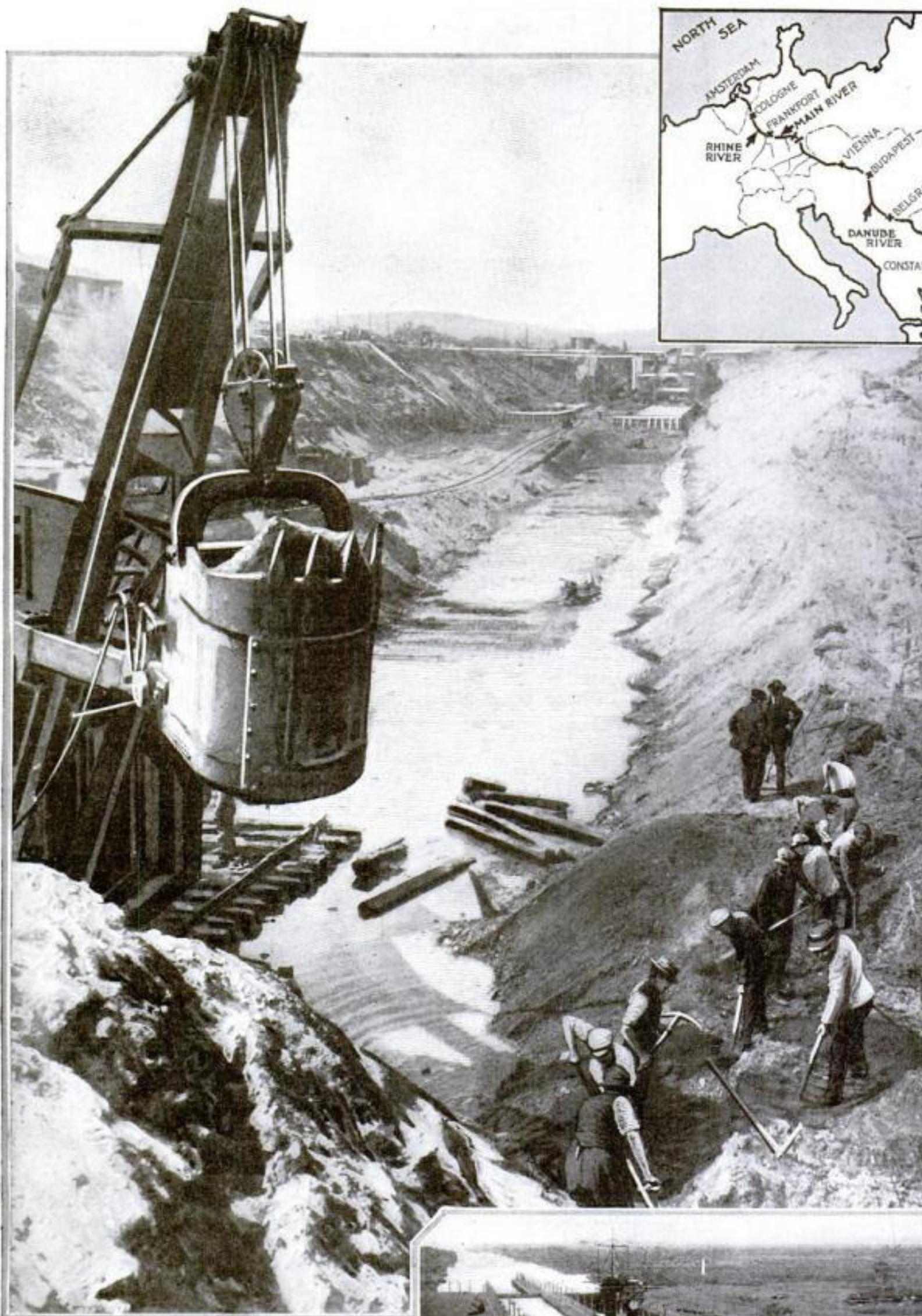
By an ingenious twisting of the blade of the saw, without endangering it, the size of the device has been reduced greatly.



Cutting a steak with the motor-driven bandsaw, controlled by a trigger



# Building a "German Panama Canal"

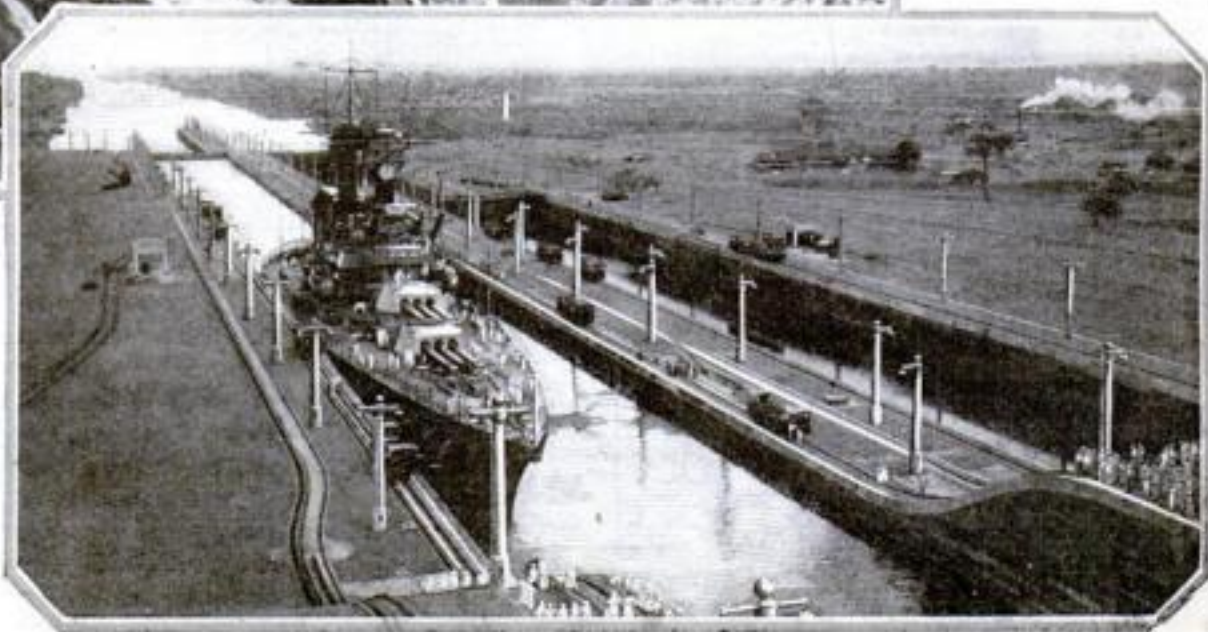


The map above shows the route of "the Panama Canal of Germany," linking the Rhine, Main and Danube rivers in a 1200-mile waterway from the North Sea to the Black Sea. Starting at Amsterdam, Holland, it will pass through the important cities of Cologne, Frankfurt, Vienna, Budapest, Belgrad, Bukharest, Braila and Galatz.

Below, a U. S. warship passing through the famous Gatun locks of the Panama Canal, with which the huge new German canal project has been compared. The photograph shows the middle and lower chambers of the remarkable locks.

**H**AVING lost the all-rail line from Berlin to Bagdad, which was to have flooded the East with German-made goods, defeated Germany now is at work on the construction of a huge canal from Amsterdam, Holland, to the Black Sea at the mouth of the Danube. The photograph shows construction work on the canal.

This great enterprise—called "the Panama Canal of Germany"—will link the Rhine, Main and Danube rivers in a waterway more than 1200 miles long. Water power generated at the locks will be used in supplying Central Europe with light and power.





# Science Creates the Super-Chicken



White Plymouth Rock (left) contributed white plumage and egg-producing qualities. Silver gray Dorking hen (right) gave soft flesh



White plumage and production of white eggs throughout the year assured by white Leghorn (right) in the first breeding



**A** NEW breed of chicken, made to order by science—a large, handsome fowl, with white plumage, soft flesh, and the ability to lay white-shelled eggs the year around—has just been announced by the United States Department of Agriculture.

Within a short time, the department says, the breed will be released to state agricultural colleges and through them to private individuals throughout the country. Further development is necessary in some minor particulars before this can be done, although the breed is already definitely fixed and established.

## A New Breed Is Evolved

This scientific product is called the Lamona chicken. It is named for Harry M. Lamon, former senior poultryman of the United States Department of Agriculture experimental farm at Beltsville, Md. After 11 years of experiment, he has evolved the cross-breeding of three varieties of fowl.

Mr. Lamon's idea was to produce a chicken that would combine the stout, ample body desired by the butcher, with attractive white plumage and the ability to produce white-shelled eggs all through the year. Brown eggs, of course, are entirely good for eating purposes, but, probably because a white-shelled egg seems cleaner and more tempting when boiled, certain markets always have been willing to pay a premium of several cents a dozen for them.

Lamon decided upon three specific breeds to use in his experiments. He took the English Dorking for its large body and the marketable quality of its flesh, the white Plymouth Rock for its bulk and its ability to lay eggs at all times of the year, and the white Leghorn because of its white eggs.

The scientific principles upon which Mr. Lamon based his experiments were the laws of heredity laid down by Gregor Mendel 50 years ago. For many years scientists have been combining the characteristics of various plants to create new varieties; but in animal breeding, progress along similar lines has been slow. The process of making cross-breeds among live stock is complicated and difficult. For this reason the success of the experiment in producing the Lamona chicken is of intense interest and practical value to the scientific world.

In poultry, egg-producing qualities de-

Below: Male and female of the new Lamona breed, produced by scientific crossing of the three varieties shown above



Lamona rooster



Lamona hen



Here are male and female of a handsome new breed of pied chicken, by-product of the experiment

scend through the male line. For that reason, roosters of the Plymouth Rock and Leghorn breeds, known to be prolific egg producers, were mated with Dorking hens in the experiments. A close-feathered white Plymouth Rock male was mated to a silver Dorking female, and a single-comb white Leghorn male was mated to another Dorking female. The Dorking is a dark-plumaged bird with five toes.

## Giving Mother Nature Some Tips

In mating the offspring of these crosses, care was taken to select only white specimens having yellow skins and four toes, and only producers of large white eggs in great quantities. As a result, unlike the Dorking, the Lamona chicken has white plumage and only four toes and produces white eggs.

As his experiments progressed, Lamon decided that his scientific chicken was to have red lobes in order to distinguish it from the single-comb white Leghorn. Poultry experts declared this would be impossible of attainment. Red ear lobes, they said, always had been a distinguishing physical characteristic of birds that produce brown eggs. Lamon, however, persisted in

his attempt, and now the Lamona chick emerges from its shell with red ear lobes as a distinguishing trademark.

The Lamona chicken is actually a new breed—not merely a cross between two types. It possesses distinctive qualities, which, after 11 years of breeding and observation, appear to be fixed so firmly that the offspring will be generally and regularly true to the new type.

The weight of the chicken is between four and six pounds. The body is long and of great depth, supplying an abundance of the always desirable white meat of the breast. It is larger than the Leghorn, approaching in size American fowl such as the Wyandotte and Orpington. It is well feathered, a fact that makes it unlikely that it will be affected by sudden changes of temperature and augurs well for its ability as a layer of winter eggs.

## Pied Birds a By-Product

An interesting by-product of the experiment was the development of a handsome pied breed, the females having pale buff breasts and the males being white with rich red wing bows and red backs. Some of these lay white and some tinted eggs. They have not been so well developed as the Lamona, but further experiments with them probably will be made because of their beauty. If this is done, the first thing to be attempted will be the intensification of the color of the females.

Similar to the experiments that produced the Lamona chicken are those undertaken by Z. T. Spencer, a man of 75 years, living near Santa Cruz, Calif., who has successfully crossed a Rhode Island Red hen with a small white Holland turkey, producing an interesting hybrid which he calls the Spencer Turken.

This new fowl, the breeding of which has progressed to the fifth generation, is fleshy, its meat being a sort of blend of chicken and turkey. It is heavy in the legs and in the breast, and it produces large brown eggs, which hatch in 23 days. The family is extremely hardy, their greater physical resemblance being to the chicken.

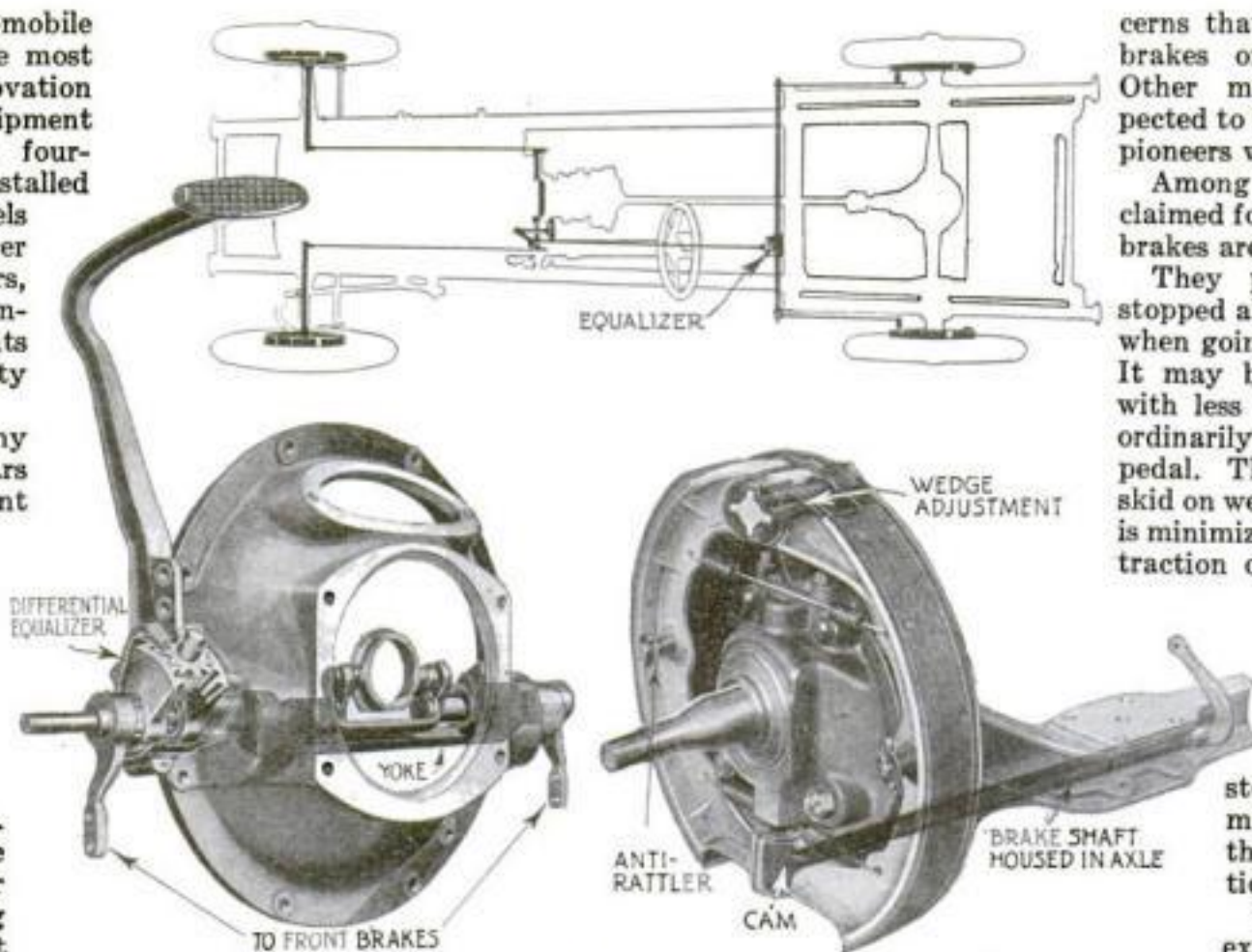
The experiments have occupied a period of four years, and experts say that seven generations of breeding will standardize the breed both in type and color.



# Greater Safety with New Four-Wheel Brakes

**H**AILED by automobile engineers as the most important innovation in automotive equipment since the self-starter, four-wheel brakes will be installed on forthcoming models of several of the larger makes of American cars, and their ultimate general adoption as agents of efficiency and safety is freely predicted.

For several years many makes of European cars have carried both front and rear wheel brakes. But American automobile engineers, although recognizing certain obvious advantages, were slow to adopt them because of certain problems connected with their use. Principal among these was the necessity for supplying less braking power to the front wheels than to the rear. If this were not done, the front wheels were likely to lock when the brakes were applied suddenly, making it impossible to steer the car. It was also necessary to furnish the front wheels with differential gearing to equalize the differ-



Top: Chassis with the new brake. Left: Clutch housing supporting front wheel operating yoke. Note differential equal-

izer in bottom of pedal. Right: Front wheel brake drum. Note holes for escape of moisture expelled by centrifugal force

ence in traction between the right wheel and the left on turns.

These problems and others are said to have been solved satisfactorily by the con-

cerns that will offer four-wheel brakes on their new models. Other manufacturers are expected to follow the lead of these pioneers within the next year.

Among the advantages claimed for these new four-wheel brakes are the following:

They permit a car to be stopped almost in its own length when going at 30 miles an hour. It may be brought to a stop with less than half the pressure ordinarily applied to the brake pedal. The tendency of a car to skid on wet or slippery pavement is minimized because the relative traction of the wheels is maintained at the same ratio when the brakes are applied as when the car is proceeding without brakes. Ordinary stops are accomplished more smoothly and easily than with the conventional rear-wheel brakes.

Brakes of the internal expanding type are favored in America for front-wheel control. American cars, manu-

facturers say, are generally sold on a basis of price rather than of performance. Those who are developing the four-wheel brakes, however, think that price is secondary to comfort and safety.

## Transmission Stops Gear Stripping

**B**Y THE installation of a new automatic transmission, it is possible to shift from one gear to another, reverse included, regardless of the speed of the car. If the brakes fail to work, the driver may engage reverse, using the engine and a gentle application of the clutch to stop the car. Gear stripping is impossible because the driveshaft is automatically disconnected when gears are being shifted.

A selector quadrant and wheel directly below the steering-wheel replace the usual gearshift lever and gears are shifted by moving this wheel after the clutch pedal has been depressed.

In the four-speed transmission, the countershaft is placed under the main shaft, and the cam shaft is located to one side of the main shaft. One complete revolution of the cam shaft meshes every gear in succession, reverse to fourth, and

while each gear is being meshed, a special cam at the rear releases a dog clutch on the tail end of the main shaft, thus disconnecting the main shaft from the propeller shaft.

Fourth gear is engaged by sliding second gear ahead until it meshes internally with a



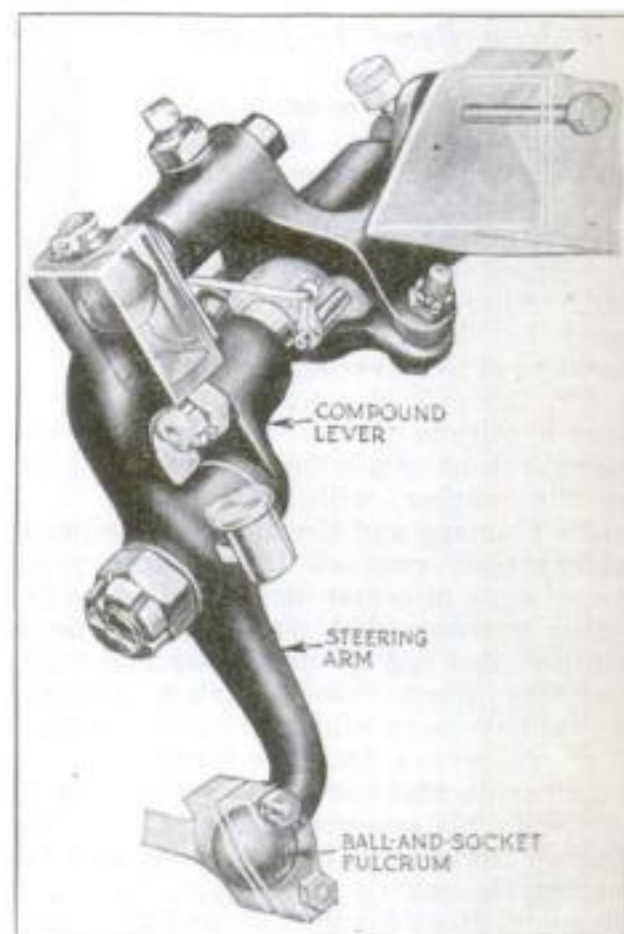
The selector quadrant and wheel used

narrow gear on the rear end of the clutch shaft. Second gear is engaged by moving this gear to the rear. Third gear is meshed by moving it forward. First gear is moved forward to give low and to the rear to give reverse.

## Straw in Steering Wheels

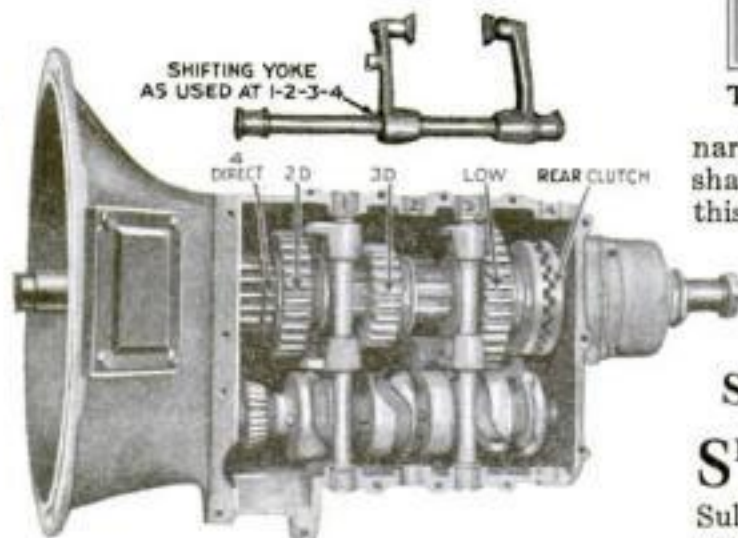
**S**HREDDED straw is an important ingredient in a Ford steering wheel. Sulphur and rubber are the other principal constituents.

This straw comes from a farm that is a part of the plant that manufactures the steering wheels.



## New Compound Lever Makes Ford Driving Easier

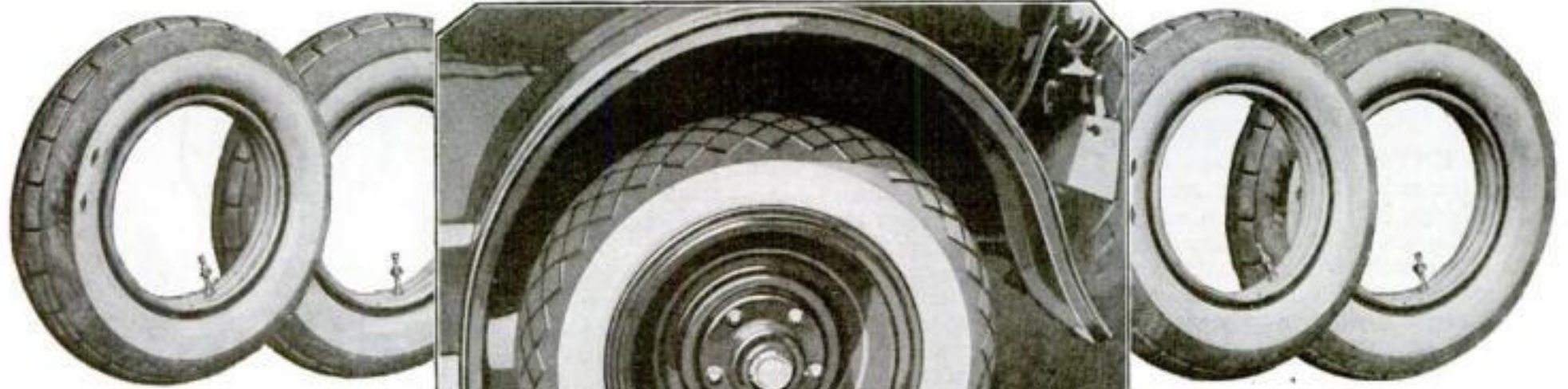
**A**DDITIONAL steering leverage for Ford cars is claimed to be obtained by substituting this compound lever for the original single lever. The device may be installed in about half an hour. It is said that it prevents the steering wheel from being jerked from the hands on rough roads and gives complete control in turning around, backing up, and turning corners sharply. It is claimed to prevent the front wheels from locking under the car.



Illustrating how one revolution of the cam shaft meshes every gear in succession from reverse to fourth



# What the Balloon Tire Offers You



**A**NOTHER distinct advance in tire development—the balloon tire—promises in preliminary tests to offer, when perfected, an even more epochal boon to the motorist than did the cord tire. The distinguishing characteristics of the new design—also known as the doughnut, air cushion, or super-cushion tire—are larger cross section and thinner walls than those of the standard tires of today.

In this novel type of construction the underlying purpose is to permit riding on a lower air pressure, thus making the car ride much easier, reducing vibration with accompanying wear and tear on the car's mechanism, and at the same time providing greater comfort and safety for motorists. Experiments by several of the large tire companies already point to its eventual success.

It is a law of tire physics that the larger the area of contact with the road the less is the air pressure required for any particular weight of car. Designers who are working on the balloon tire believe that the high pressures of ordinary pneumatic tires convey to the car and its occupants an unnecessarily large proportion of each road shock, just as does any rigid connection. Hence, the balloon tire is so constructed that it can be used considerably deflated, with air pressure of only 35 pounds, or even still lower.

The ordinary tire is designed for high pressures. Deflation tends to separate the tread and plies. Moreover, the walls, thick to withstand high pressures, tend to bend along one rather narrow line, just as a piece of cardboard bends more sharply than a piece of writing paper. This tendency is destructive to the tire wall.

The lower pressure in the balloon tire permits thinner and differently constructed walls, which bend less sharply and hence are more durable at low inflation.

The designers concede that thus far the balloon tire is little more than a promising experiment. Yet the enthusiastic unanimity with which one group of experimenters—six taxicab drivers—recently testified to the shockless riding of the new tires is impressive. Each ran his car about 4000 miles with them. They reported that all road irregularities such as the ordinary tire would convert into distinct



Because of its thinner, more resilient walls and lower air pressure, the new balloon tire above is less likely to be damaged by contact with the sharp curb

At the left: The tread imprint of a 7.30 balloon tire with 35 pounds air pressure, as compared with that of a 33 by five-inch high-pressure pneumatic with 65 pounds pressure. Note increased contact with the road

shocks, to the discomfort of passengers and the harmful jarring of the mechanism, either were smoothed out remarkably or completely eliminated.

These results, of course, were to be expected to some degree. Automotive experts long have recognized that high pressure makes the air in tires less yielding. They have clung to high pressures because they believed that partial deflation neces-

sarily was destructive. But only two blowouts occurred during comprehensive tests with the balloon tire, indicating not the slightest damage from partial deflation.

It was found that the new tires accommodated themselves, because of their air content and thin walls, to the irregularities of the road. Crossing tracks, for example, was found to deflect the wheels scarcely at all, even when the car was running nearly parallel with the rails. In one test a car actually was driven down a railroad bed over the ties, with surprisingly little discomfort to the passengers.

Superior responsiveness to brakes and comparative freedom from skidding also are claimed for the new tire. The larger area of contact holds to the road better when a sudden stop is necessary or when slippery pavements make steering difficult. Moreover, hill-climbing is said to be easier and surer because of better road contact.

Probably this securer contact, which explains the superior hill-climbing, anti-skid, and brake-responsive qualities claimed for the new tire, explains also the somewhat smaller gasoline consumption recorded by the test cars. Apparently each revolution of the rear wheels gave greater impetus and less slippage to the car than is possible with the usual type of tire. The mileage to the gallon attained by the test cars averaged 13.5. That achieved by a group of cars engaged in similar service and equipped with cord tires was 12.6.

The striking freedom from punctures and blowouts demonstrated in the tests of the new tire is attributed to its low air pressure. The makers believe that low inflation makes the tire yield somewhat to any sharp object.

Against these striking advantages claimed for the new tire are a few conceded defects, including unsteadiness of the front wheels and a "galloping" motion that affected all the test cars not equipped with snubbers or shock absorbers. Another disadvantage is that the tire, because of its large contact area, throws an astonishing quantity of dust and mud.

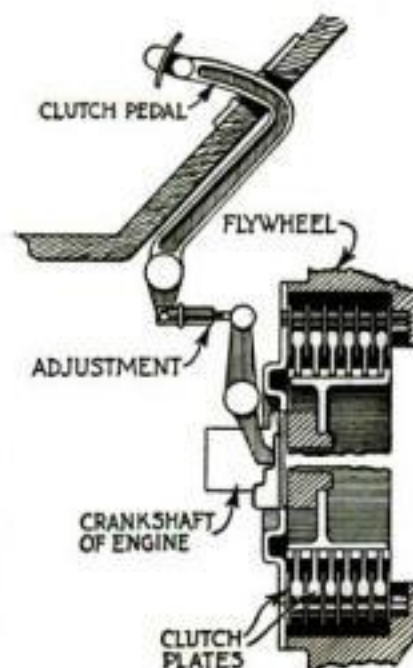
But while the balloon tire is still in its experimental period, its essential principles seem to have vindicated themselves. Inventive genius undoubtedly will find a way to circumvent its disadvantages.

## Know Your Car

### The Clutch

**T**HIS is a device that connects and disconnects the engine and transmission so that the car may or may not move while the engine is running.

The multiple disk type clutch is illustrated here. There are two chief parts, one part attached to the crankshaft; the other to the transmission. Each has a series of disks or plates so arranged that they engage one another by friction when the clutch is "in," causing one series of plates to drive the other. When the clutch is thrown out, the parts are separated and the engine can run without having any effect upon the car.





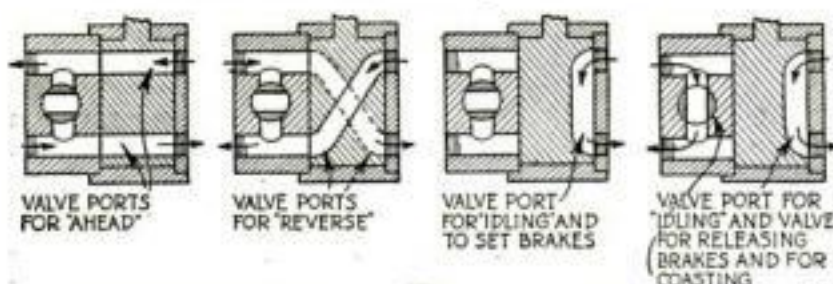
# Oil Transmission Replaces Gears

## Single Lever Controls All Speeds and Applies Brakes in Remarkable New System

**A**N ENTIRELY new system of oil transmission for automotive vehicles, invented by two engineers of Grand Rapids, Mich., is designed to eliminate the clutch, driving shafts, gears, and brakes. A single lever controls all forward and reverse speeds as well as serving to apply the brake and to disengage the engine for idling.

The transmission system consists of a pump connected directly with the power shaft of the gasoline engine; two motors connected with the two driving wheels of

bypassing the oil when idling. When the cylinder is turned so that two holes in it lie exactly over the inlet and outlet pipes, the oil passing through exerts forward pressure on the motor. Two spiral cuts around the cylinder serve to lead the oil into the return chamber of the motor, causing the rotor to reverse. A single axial groove is used to return the oil to the pump.



The grooved cylindrical core and housing of the transmission control valve are shown at right. Above are operating positions of the valve ports for going ahead, reverse, idling, braking, and coasting. Speed variations depend on the valve opening.

the car and driven by oil circulated by the pump; an ingenious valve controlling the flow of the oil, and a number of pipes that conduct the oil from the pump to the wheel motors and return.

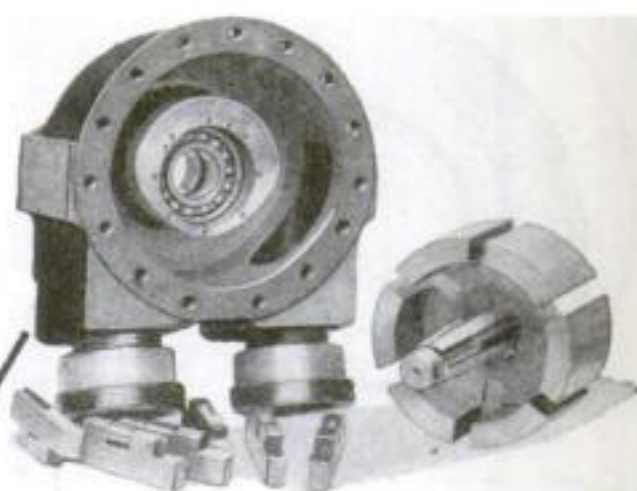
A circular disk, eccentrically mounted in the elliptical pump chamber, has six slots in its circumference that contain rectangular sliding bars. As the disk rotates, these bars are forced against the inner surface of the chamber by a cam, each pair of bars forming a space the size of which changes as the mechanism turns. As the bars are moved away from the oil inlet in the pump, the space becomes larger, thereby drawing oil into the pump. When the bars approach the outlet, the space becomes smaller, forcing out the oil. In this way a continuous flow of oil through the pump is maintained.

The motors are similarly constructed, operating under the pressure from the pump, the oil being discharged at the outlet and being sucked back into the pump.

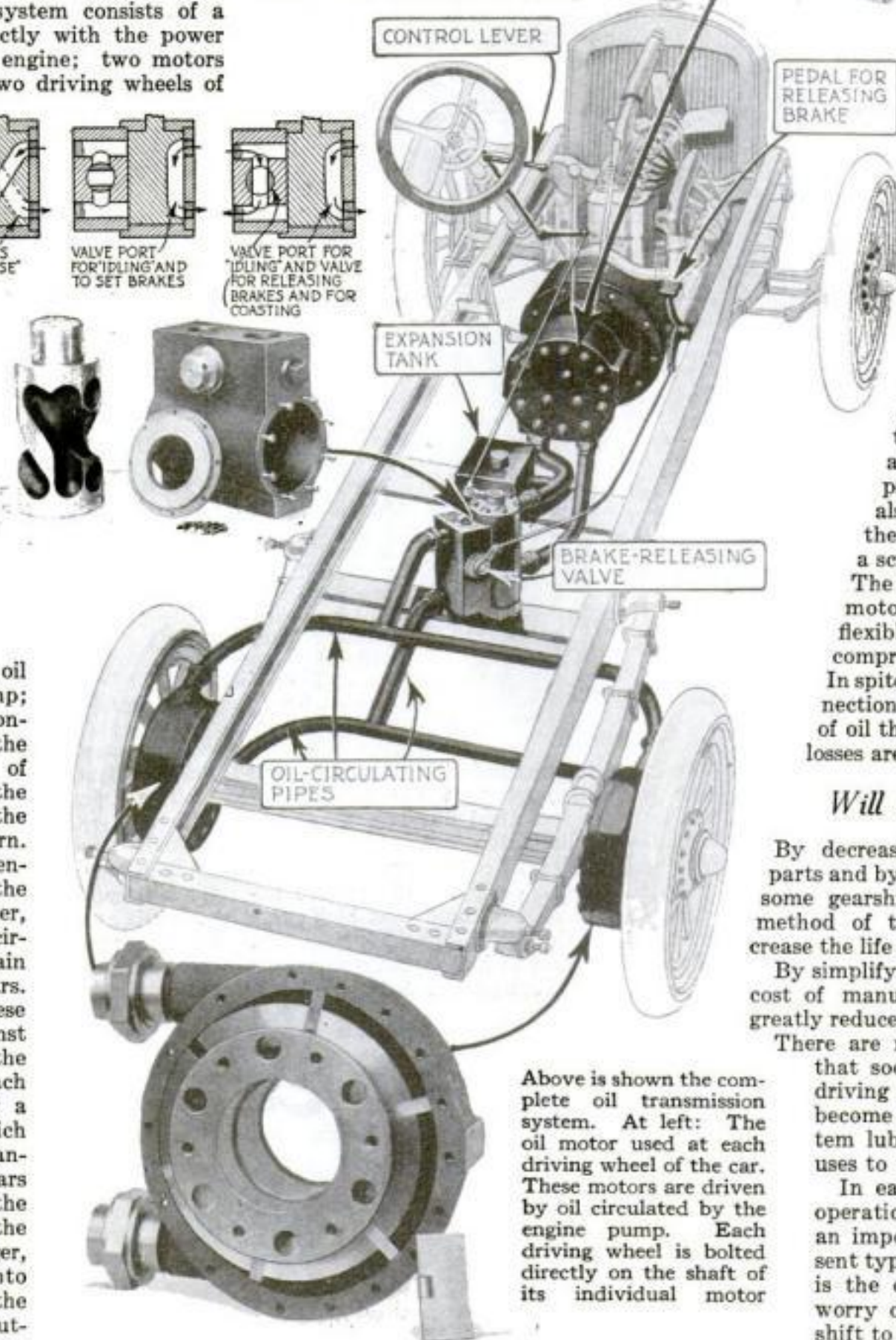
A control valve, placed in the circuit between the pump and the motors, consists of an adjustable cylinder containing a number of slots and grooves, the position of which determines direct flow, reverse, and for

without permitting it to pass through the motors. In this way the motor can be left running while the car is stationary.

Since the rate of turning of the motor is dependent upon the pressure exerted by the oil, the medium speeds can be obtained by blocking part of the oil by means of the valve. By partially opening the valve, only a small amount of oil can pass, and as this opening is gradually widened, the speed of the vehicle is increased. By shutting off the power completely while the car



Above is the oil-circulating pump, driven by the auto engine. It is directly connected with the engine shaft, as indicated by arrow, and always runs in tune with the engine.



Above is shown the complete oil transmission system. At left: The oil motor used at each driving wheel of the car. These motors are driven by oil circulated by the engine pump. Each driving wheel is bolted directly on the shaft of its individual motor.

is running, the motor acts as a pump and thus, since the oil is blocked, the system acts as a brake.

A vented tank is inserted in the oil system to allow for expansion and contraction of the liquid and external leakage, as well as to relieve the pressure on the return pipe. It also allows an escape for air in the circuit and is provided with a screw cap for filling the system. The pipe sections extending to the motors on the wheels are made of flexible steel tubing to allow for compression of the chassis springs. In spite of the flexibility of these connections there is no appreciable loss of oil through them and the pressure losses are negligible.

### Will Increase Auto's Life

By decreasing the number of moving parts and by doing away with the troublesome gearshifts, it is claimed that this method of transmission will greatly increase the life of automobiles.

By simplifying the structure, the weight, cost of manufacture, and upkeep will be greatly reduced, the designers assert.

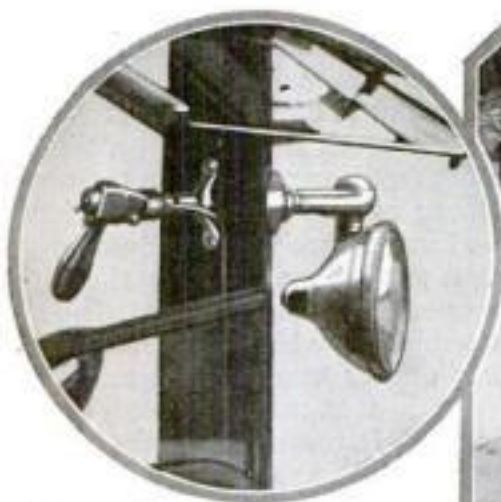
There are no brakes to require linings that soon wear out. There are no driving shafts or universal joints to become worn out. Finally, the system lubricates itself with the oil it uses to transmit the power.

In ease, simplicity, and safety of operation, the system is said to be an important advance over the present types of transmission. Not only is the driver freed of the constant worry of gear stripping, but he can shift to any speed with one lever.

**I**N EVERY section of the United States where the seasons are extreme, the coming of winter invariably brings with it a curse to the auto owner. A helpful article in next month's issue will tell how to prepare and care for your car so that winter driving will become a pleasure rather than an experience to be dreaded.



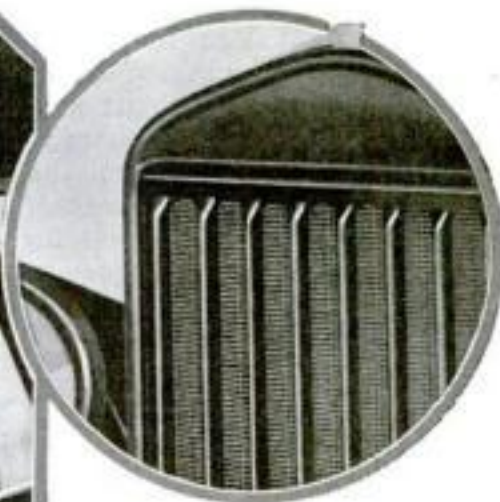
# Useful New Accessories for the Auto Owner



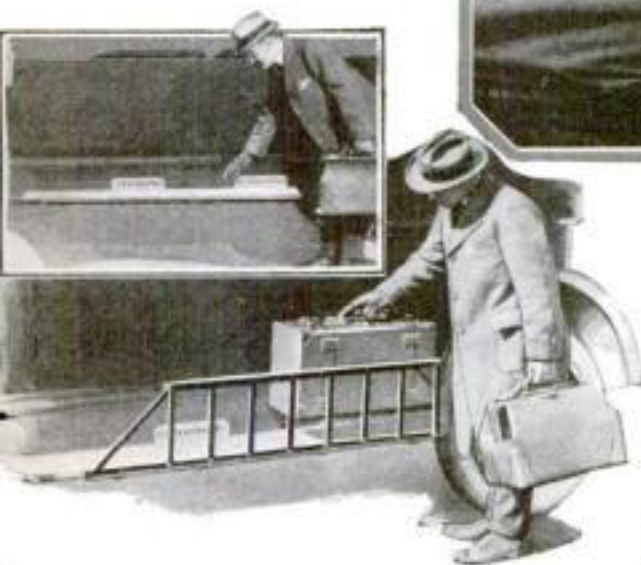
Controlled from behind the windshield, this unusual spotlight is pivoted to cast a brilliant beam of light in any direction. It holds its position on the roughest roads



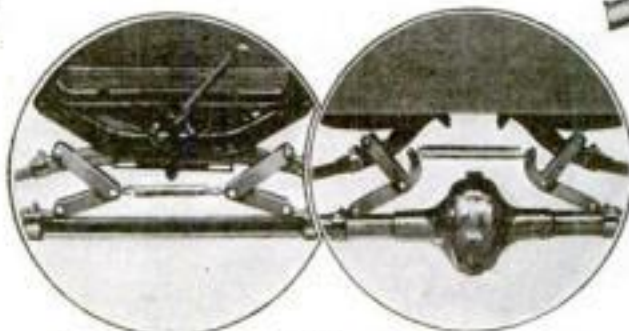
Lighting cigar or cigarette with one hand while driving a car is simplified by an ingenious electric heater attached to the dash lamp socket. Pressure on a contact plug at the top of the device lights an electric coil



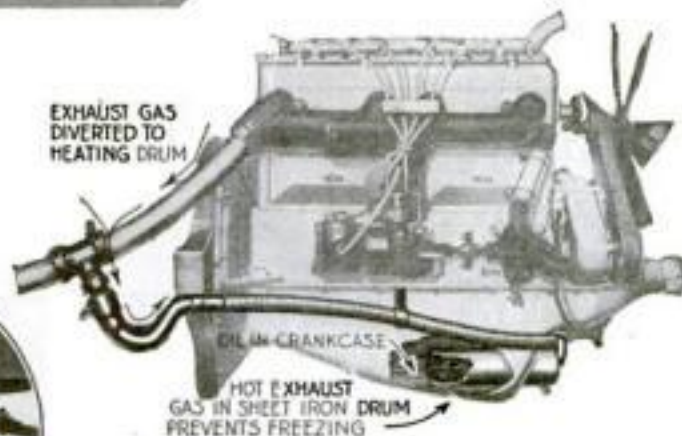
Many a radiator has been bent or broken by collision with another car. This new protector, consisting of a series of steel bars, saves the radiator while providing sufficient air space for cooling



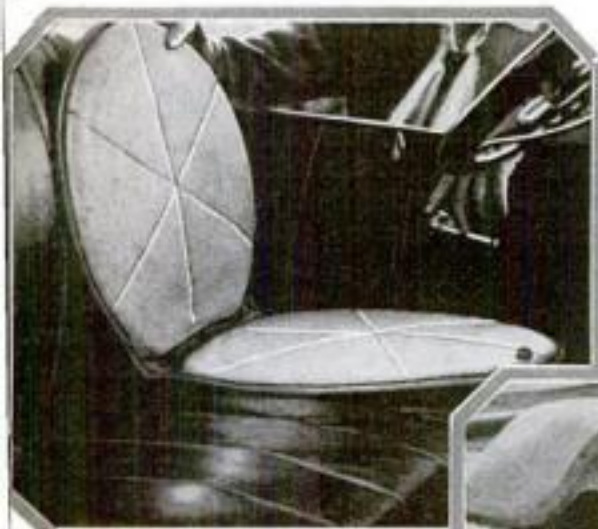
A disappearing grip rack for the runningboard folds into an inconspicuous metal strip that edges the board when the rack is not in use. When unfolded upward, it becomes a sturdy metal frame held firmly by bolts. Slots are provided for straps to bind luggage tightly to the frame of the rack



A new shock snubber for Ford cars consists of two levers, the lower ends of which are bolted to the front or rear axle, the upper ends connected with a spring. Both levers are attached to the springs of the car through toggles

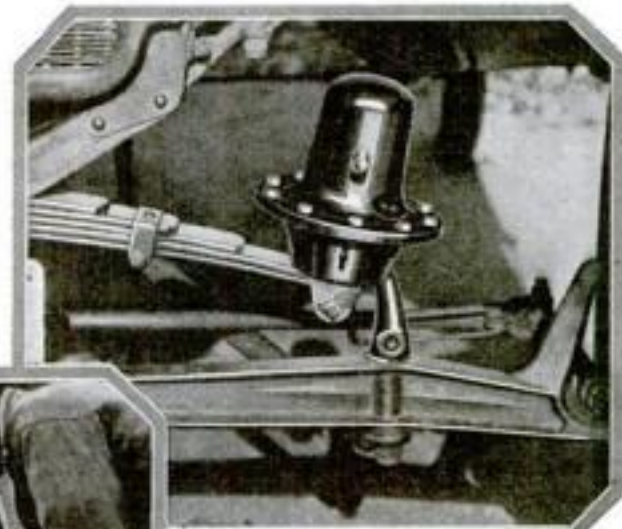


Freezing of oil in the crankcase is prevented by this exhaust heater. Moist vapors that get by the piston rings pass out through the breather pipe instead of condensing into water and mixing with oil. Hot exhaust gas is passed through a sheet-iron drum introduced into the front of the crankcase



This novel motor cushion for the driver is made of an 80-foot coiled spring, wound spirally and covered closely with a woven textile. It gives not only a cushioning effect, but provides air space that prevents perspiration on a long drive. When not in use, it folds into a flat cylindrical shape

With the simple gage shown below, the motorist can tell instantly whether his car wheels are out of alignment. The stop is placed against the inside felly of one front wheel. The curved portion on the opposite side straddles the opposite wheel. A gage rod then is run against the outside felly and a reading taken with a rule



Road shocks are absorbed by a cushion of air in this bell-shaped absorber that consists of an inflated air chamber sealed by a flexible diaphragm rocking on a vertical arm. The diaphragm extends from the axle and forms the connection between axle and spring. The absorber is inflated occasionally like an auto tire



# How to Rebuild a Broken-Down Car

By Ray F. Kuns

Principal, Automobile Trade School  
Cincinnati, Ohio

**N**OW that you have stripped the frame and cleaned up the chassis units, as outlined last month, sound all the rivets by tapping them with a ball peen hammer and replace those found loose. If you lack the tools necessary to insure a good job of hot riveting, enlarge the old rivet holes to take cap screws and nuts. A 5/16-in. rivet hole is enlarged to take a 3/8-in. bolt, and other sizes may be used in proportionate measurements.

When bolting the frame parts together, always use strong, new lock washers. In some instances, the bolts are preferable to the original rivets.

Stretch stovepipe wire tightly from the center of the front cross member to the center of the rear cross member of the frame, making measurements from this wire to see that the frame is straight and true. If it is sprung downward or sidewise, use chains and jacks to pull it back in place.

Bushings in the front axle and steering gear must be snug. New bushings can be pressed into the spindle body very easily in the vise. The bushings must then be reamed to fit the pin or bolt that is to be used. This operation is illustrated in Fig. 3, where an adjustable reamer is being used.

For bushings in the spindle body and tie rod arms, the fit should just permit the bolt to be forced in by hand or with a light blow. For spring bushings the fit might be a trifle looser and for piston pin bushings, the pin should be tight enough so that it can just be forced in by hand.

When reassembling the steering gear and front axle, special care must be taken to see that a proper fit is provided for all moving parts. The wheel bearings should fit so that the weight of the valve cap on the tire will cause it to seek bottom. Make certain that no dirt gets into the bearings and pack them in cup grease. See that all oiling devices are in good condition. If an old system of cups is in use, it will pay to discard them and substitute a pressure grease gun.

The method of adjusting the thrust on the worm of the steering worm gear is indicated in Fig. 2. It should be sunk enough to prevent end play on the worm shaft and yet not allow the thrust bearings to bind.

When the springs are reassembled, the shackles are made tight enough to prevent any play, but not so tight that they grip the spring end rigidly. When the shackles are too tight, there is a disagreeable chirp as the car passes over road bumps, and in bad cases the master leaf of the spring will be broken. The spring clip nuts must be made quite tight; after the car has seen a little service they must again be tightened. This will prevent breaking at the center bolt hole.

**T**HE third and last article in this series on overhauling used autos will appear next month. In it Mr. Kuns tells in detail just how to reassemble the engine and repair the ignition, accessories, body, and top.

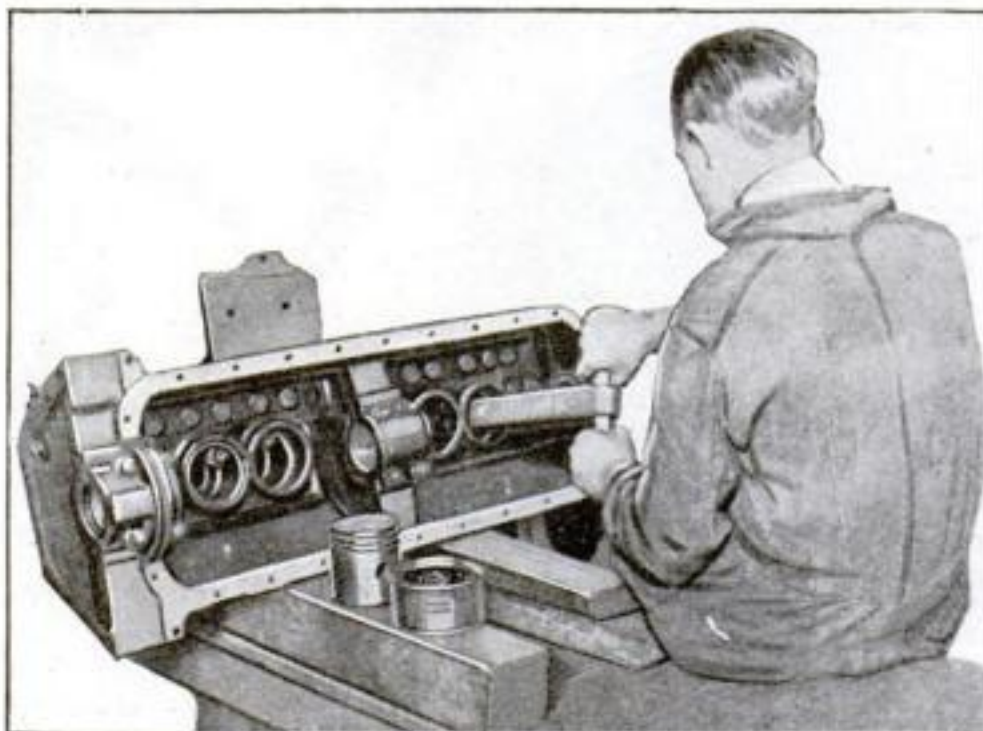


Fig. 1. Lapping a scored cylinder with the old piston used as a lapping tool

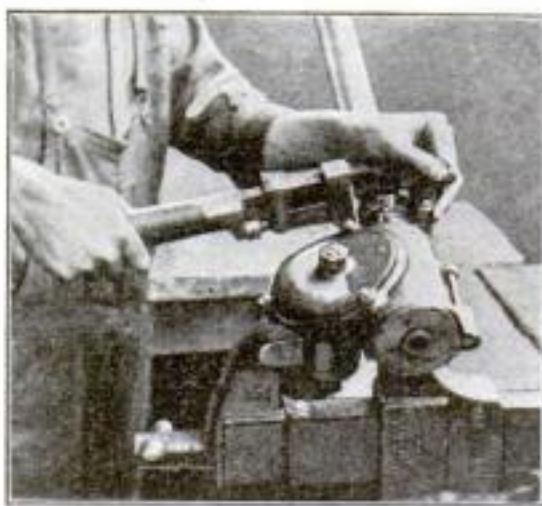


Fig. 2. Adjusting the thrust on the worm of the steering worm gear

The center bolt, too, must be kept snug.

In repairing the rear axle of this particular roadster, it was necessary to remove and replace the old ring and pinion gears with new ones. When riveting a ring gear in place, it is necessary to proceed as in Fig. 4. A mistake commonly made in this work is to attempt to rivet the gear to the differential housing without first bolting the parts rigidly together with three or four equally spaced cap screws. This results in the far edges separating as the first rivet is drawn down, and frequently

separation cannot be overcome entirely, with the result that the gears always growl.

When adjusting the ring and pinion, allow a barely perceptible amount of backlash. If too much is allowed, the assembly is weak and noisy; if too little, the axle will run hot and noisy. A good method of adjusting these



gears is to use red lead for checking the contacts. These should be adjusted until the red lead shows a line of contact the full length of the tooth rather than a tapering spot on the front or rear end of the teeth.

The taper roller bearings should be adjusted to have a barely perceptible amount of play. A good plan is to bring the adjusting ring or collar up until the bearings show a slight tendency to bind and then back off the collar one or two notches and lock it in that position.

In reassembling the rear axle watch the provisions for lubrication. See that all felt grease retaining gaskets are new and properly installed. Take particular pains to see that the grease can not work out into the brake drums and lower the efficiency of the brake.

Make new gaskets for the axle housing inspection plate and the differential carrier mounting. Heavy brown paper may be used for this, but every particle of dirt and remnant of the old gaskets must be removed. Rim and gaske shellac or cup grease may be used to help make the joint snug and leakproof.

Go over the brake mechanism carefully and rebuild a worn parts. Where pins are worn in the brake clevises, the holes are drilled out for large

pins, which may be made from cold rolled rod with a cotter key in each end.

Brakes should be relined with the best grade lining of proper width and thickness. When applying the lining to the internal expanding bands, little trouble is experienced, but there is always a tendency to curl the lining over the external bands too soon so that it will have flat sections. To prevent this, allow about 3/4 in. more than the apparent length and then rivet each end. After the ends are secure, the buckle is hammered out or forced to lie against the inside of the brake band. This insures a good fit and the riveting may then proceed.

The best rivet to use is a solid copper one with a long tapered head, rather than the flat head or belt rivet, or even the split rivet. Never use iron rivets, as they will cut the brake drums and are sure to give a noisy brake. The heads of rivets are always carefully countersunk so that they do not come in contact with the brake drum. Set

the rivet head on the end of a punch while riveting up the burr.

When adjusting the brakes, set them up until there is 1/64 in. space under the band at every point. New bands or linings must be run in before final adjustments can be made.

Transmissions, as a rule, give little trouble but it is well to pull the gears and inspect the bearings and shaft. You may find the second-speed gear tapered or broken, since this is the one that most often makes trouble. If

(Turn to page 108)

Fig. 3. (At left) Reaming a new bushing. Fig. 4. (Above) Riveting the ring gear in place





# The Home Workshop

Arthur Wakeling, Editor

## Build a Child's Pullman Play Table

**N**OTHING pleases the kiddies so much as to have a play table of their own, just made to suit them, with comfortable seats and a drawer to keep their picture books, crayons, cutouts, and other small belongings.

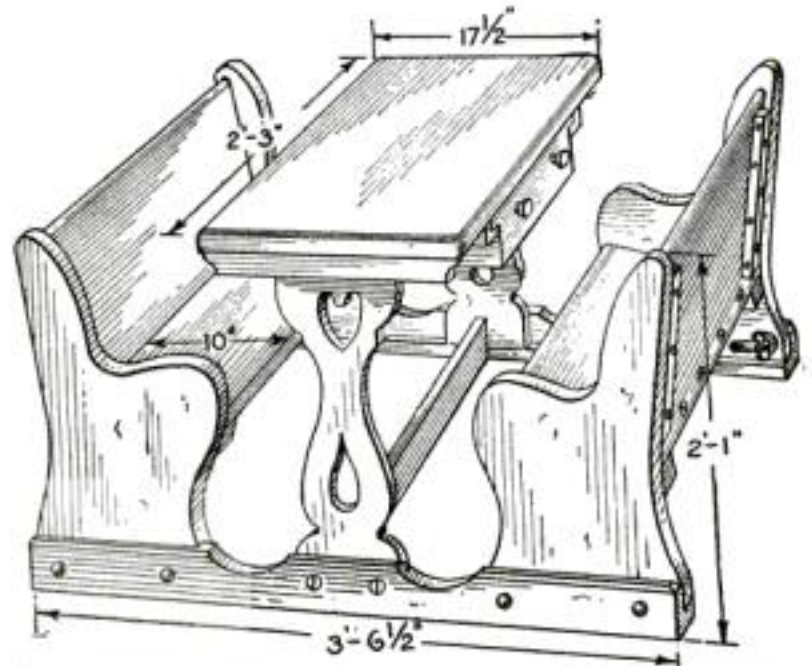
The table illustrated is especially designed to meet their needs. Built like a miniature of a "grown-up" Pullman dining alcove, it has a fascination for children far in excess of any ordinary small table, and they will spend many happy hours playing at it during the late fall and winter months, when stormy weather forces them to stay indoors.

Simple and sturdy of construction, the table can be constructed quite easily even by home workers who have not had much experience in handling woodworking tools, and the expense for lumber is small. This makes it an excellent project to be constructed as a Christmas present—much more so than the average toy, because it has real utility and can be made most attractive by careful finishing and decorating. Whitewood or pine may be used if the table is to be enameled, or cypress if it is to be stained and varnished.

The parts are set up on two rabbeted stretchers,  $1\frac{3}{4}$  by  $3\frac{1}{2}$  in. by

One large drawer, 18 in. wide,  $16\frac{1}{2}$  in. long and  $3\frac{1}{2}$  in. deep, is hung on cleats under the table top and slides out in either direction. This makes it impossible for the children to spill the contents, and the drawer itself can be divided inside if desired.

The seats are of equally simple construction. The backs,  $\frac{1}{8}$  by  $14\frac{1}{2}$  by 23 in., and the seats,  $\frac{1}{8}$  by 10 by 23



This play table, which is a miniature Pullman dining alcove, delights the kiddies more than many elaborate toys



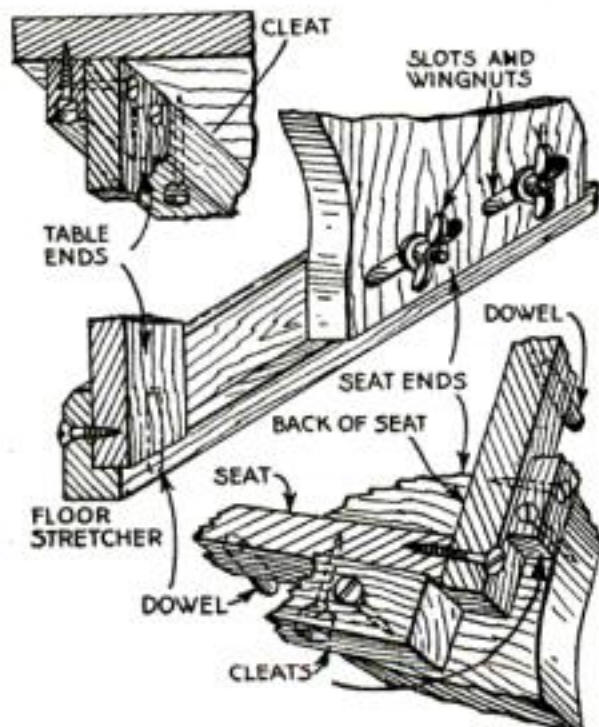
in., are doweled into the ends and reinforced by cleats.

The whole play table is narrow enough so that it can be carried through any ordinary doorway, and it can therefore be moved from room to room or taken out on the porch or lawn in the summer.

The ideal way to finish the play table is to enamel it some light color and decorate it with nursery figures or animals in bright colors. These decorations can be hand-painted in oil colors, transferred with decalcomanias, or cut from picture books, cemented in place and varnished.

The table was especially designed for the Home Workshop by George F. Kaercher, of Philadelphia, for many years a furniture factory superintendent and designer. The idea was suggested by Mrs. H. A. Smith, of Dexter, Ia.

Full working details of the table, and a complete bill of materials are contained in Blueprint No. 28, which will be sent for 25 cents. Address Blueprint Service Department, Popular Science Monthly, 225 West 39th St., New York.



Details showing how the table top is fastened and the seats are put together

3 ft.  $6\frac{1}{2}$  in. The table ends,  $\frac{1}{8}$  by  $8\frac{1}{2}$  by  $22\frac{7}{8}$  in. over all, are fastened to the center of these floor pieces with dowels and screws, and are braced by a foot rail or stretcher. The seat ends,  $1\frac{1}{8}$  by  $14\frac{1}{2}$  by 24 in., are slotted, so that the seats can be adjusted back and forth, as found most comfortable, and fastened with wingnuts.

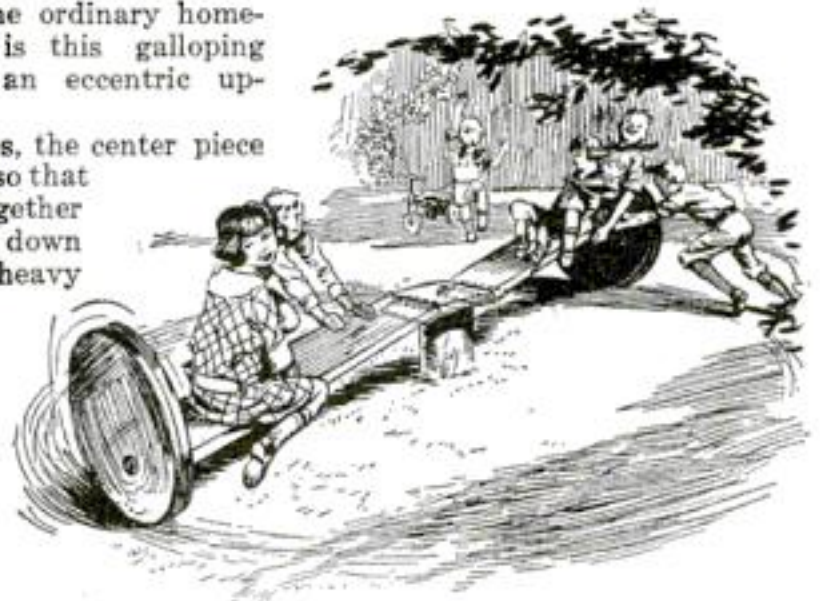
At the top the table ends fit into recesses cut in the  $1\frac{3}{4}$  by  $1\frac{1}{2}$  by  $16\frac{1}{2}$  in. top cleats or rails, and to these rails is screwed the top, which is  $1\frac{1}{8}$  in. by  $17\frac{1}{2}$  in. by 2 ft. 3 in.

## Making a Galloping Merry-Go-Round

**M**UCH more fun than the ordinary home-made merry-go-round is this galloping carousel. It gives an eccentric up-and-down motion.

Cut the plank in three pieces, the center piece being square, and bevel the cuts so that when the pieces are hinged together the end lengths can move up and down in relation to the center. Four heavy T-hinges are placed on the under side of the joints. The central support can be an old stump or a wooden block set in the ground.

The seesaw motion is created by two wheels pivoted eccentrically to the ends of the plank, turning on bolts or lag screws set 4 in. off center. The wheels are of two layers of 1-in. lumber about 3 ft. in diameter.—D. R. V. H.



Eccentrically mounted wooden wheels give an up-and-down motion to the hinged ends of the merry-go-round plank here illustrated



# Adding Radio Frequency to a Standard Set

By Joseph Calcaterra

Of POPULAR SCIENCE MONTHLY'S  
Radio Staff

**D**ISTANCE, more distance, and still more distance is the goal of the average radio fan. The ability of a set to reach for distant stations can be increased greatly by the addition of two or three stages of radio frequency amplification.

By following the instructions given in this article it is possible to add three stages of radio frequency amplification to your present set without the necessity of changing the wiring, if the set has a double circuit tuning element. If your receiver uses a single circuit type of tuning element, only two minor changes of the detector circuit wiring are necessary.

With this unit it is possible to use the complete set with or without the radio frequency stages merely by changing the aerial and ground connections.

The unit consists of three stages of variometer coupled and tuned radio frequency amplification. By its use stations more than 1000 miles away are brought in easily.

The general layout of the panel and instruments can easily be seen from Fig. 1. The panel can be made of any approved panel material and should be 24 by 7 by 3/16 in.

In order to avoid confusion in wiring, all the parts have been lettered so that the wiring can be traced from point to point.

## Wiring the Unit

A, J, E, F, G, H, and I are binding posts. A and J are the aerial and ground terminals respectively. E and I are the posts that are to be connected with the aerial and ground posts of your present set. F is the B battery binding post; G the positive A battery terminal. In the upper view the terminal G is hidden from view by the potentiometer, but its position is shown by dotted line, and can easily be seen. H is the negative A battery connection.

B, C, and D are the tap switches for varying the number of turns or inductance of the variometer stators. These tap switches are desirable but not absolutely necessary. If standard variometers with large size rotors are used in place of the homemade variometers, no tap switches are necessary.

R<sub>1</sub>, R<sub>2</sub>, and R<sub>3</sub> are the rheostats that control the filament current of their respective tubes, 1, 2, and 3.

V<sub>1</sub> is the variometer that acts as the tuning element of the receiver. V<sub>2</sub> and V<sub>3</sub> are the other two variometers made in the same manner as V<sub>1</sub> and furnish the coupling between the first and second and the second and third stages. The coupling between the third stage and the detector stage is furnished by the tuning elements of the standard receiver with which the unit is to be used.

P is a potentiometer of 200 or 400 ohms and is used to adjust the proper operating potential on the grid of the first tube.

C<sub>1</sub>, C<sub>2</sub>, and C<sub>3</sub> are fixed condensers of .001 mfd. The first two are used between the variometers and the grids of the succeeding tubes, while the last is used across the movable arm of the potentiometer and the negative A battery lead.

The photograph of the variometer (Fig. 2) shows the details of construction of this instrument so that long explanations for its building are not necessary. The stator tube should be four inches in diameter and

A piece of No. 18 or No. 20 wire looped over the shaft and anchored with screws and nuts projecting from the stator tube serve to hold the rotor in place. At the rear of the rotor one of these screws is allowed to project and serves as a stop for the rotor.

Two other screws projecting through the front of the stator tube and held in place by nuts provide means for fastening the variometer to the panel. The top screw can be placed about 3/8 in. below the center point of the rotor shaft bearing slot, while the other can be inserted about 3/8 in. from the bottom end of the tube. Care must be taken that these screws are placed directly below the shaft center line, as otherwise difficulty will be experienced in mounting the variometer on the panel. About two nuts should be threaded on each screw to keep the variometer a short distance from the panel.

The stator should be wound with 60 turns of No. 24 single or double cotton covered wire. A tap is taken at the twentieth turn from the top and four more taps are taken at every 10 turns.

The rotor may have from 30 to 60 turns. Any rotor wound full with No. 24 wire will do.

The shaft hole for V<sub>1</sub> is drilled 2 3/4 in. from the top and 3 in. from the side of the panel. The other variometer shaft holes are drilled 7 in. from each other. The axes of the

variometers are placed at an angle of 30 degrees to the vertical to reduce interaction between stages to a minimum.

## Shielding the Variometers

Three pieces of thin sheet brass or copper about four inches square, with holes spaced to allow the variometer fastening screws and shaft to pass through, are placed as shown in the photograph. When grounded, these act as shields and prevent bothersome capacity effects.

Follow this order in wiring and use the shortest connections possible. First, connect the variometer stator taps with the inductance switch contacts. In each variometer, the first tap, at the end of 20 turns, is connected with contact 1, the second tap with contact 2, and so on down to the last tap. The taps of V<sub>1</sub> are connected with the contacts of switch B, those of V<sub>2</sub> with switch C, and those of V<sub>3</sub> with switch D.

Next, the filament circuit should be wired. Lead a wire from terminal G to one binding post of each rheostat, to one of the outside terminals of P, and to one terminal of C<sub>3</sub>. Lead another wire from H to one of the F terminals of each tube socket and to the other outside terminal of P. Now connect the middle terminal of the potentiometer P with J and with the remaining terminal of C<sub>3</sub>.

From each of the remaining terminals of the rheostats run connecting wires to the remaining F terminals of their respective tube sockets.

(Continued on page 127)

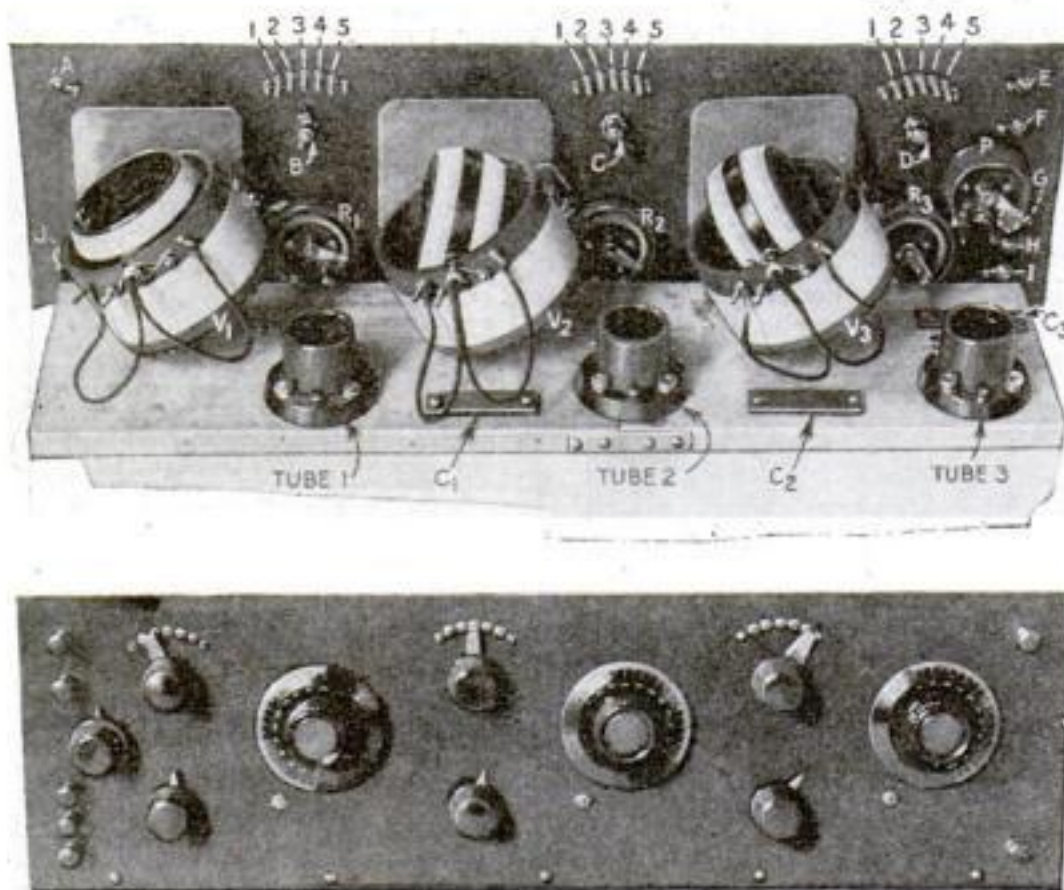


Fig. 1. The location of the various parts of the radio frequency unit are shown in the above rear and front views. Terminal G is hidden by the potentiometer P, but its location is shown by the dotted line

three inches long. The rotor should have a diameter of about 3 1/2 in.

A slot 3/8 in. deep and 1/4 in. wide is filed at the top of the stator tube to receive the front end of the rotor shaft. A similar slot is filed at the opposite point of the stator to receive the rear rotor shaft. Several fiber or metal washers slipped on the front and rear shafts of the rotor and placed between the rotor and stator will center the rotor and provide the required friction to hold the rotor wherever adjusted, if the washers are of such thickness as to spring the stator tube slightly. The fiber washers used in faucets will answer the purpose.

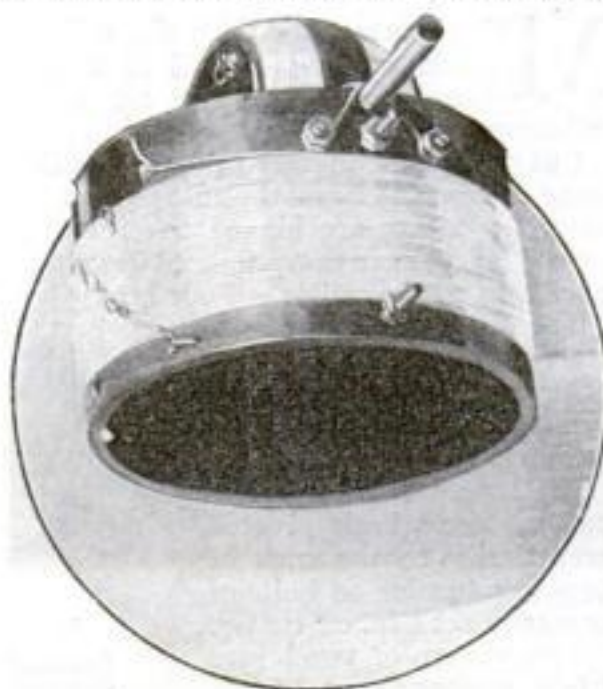


Fig. 2. Constructional details of the variometers are shown in the above illustration



# The Proper Finish Will Make Your Furniture Harmonize



Small odd pieces of modern furniture add greatly to the attractiveness of every home. You, yourself, can easily make them for your family. There is no particular trick to constructing porch swings, tables, telephone sets, etc.

The furniture, woodwork and floors of your home can be made to harmonize if a little taste is used in finishing them. You can easily refinish dingy, shabby, scratched wood. Our method involves practically no expense. All you need is a little time—a brush—and **JOHNSON'S WOOD DYE.**

Johnson's Wood Dye is very easy to apply—it goes on easily and quickly, without a lap or a streak. It penetrates deeply, bringing out the beauty of the grain without raising it—dries in four hours and does not rub off or smudge.



## JOHNSON'S WOOD DYE

If you are building or remodeling you should have our book on Wood Finishing. It is chock full of valuable information. Tells just what materials to use and how to apply them. We will gladly send it free and postpaid. Use coupon at right.



**JOHNSON'S WOOD DYE** has many uses, for both the artisan and amateur. *Architects and contractors specify it* for coloring woodwork and flooring in new buildings. *Painters and decorators* use it with equal satisfaction on new and old woodwork of all kinds. *Housewives* delight in it for doing over old furniture and for coloring reed and wicker baskets, etc.

**JOHNSON'S WOOD DYE** is made in fourteen standard shades—a few of which are:

129 Dark Mahogany	126 Light Oak
127 Brown Mahogany	123 Dark Oak
140 Early English	110 Bog Oak
131 Walnut	124 Golden Oak
125 Mission Oak	

All shades may be easily lightened, darkened or intermixed. Full directions on every label.

### FREE-This Book on Home Beautifying

This Book tells how to finish wood in artistic stained and enameled effects. Gives practical suggestions on making your home artistic, cheery and inviting. Tells just what materials to use and how to apply them. Includes color card—gives covering capacities, etc. Use coupon below.



S. C. JOHNSON & SON, PS11  
RACINE, WIS. (Canadian Factory—Brantford)

Please send me free and postpaid your Instruction Book on Home Beautifying and Wood Finishing.

The best dealer in paints here is .....

MY NAME.....

MY ADDRESS.....

CITY & STATE.....



# Better Shop Methods

How Expert Mechanics Save Time and Labor



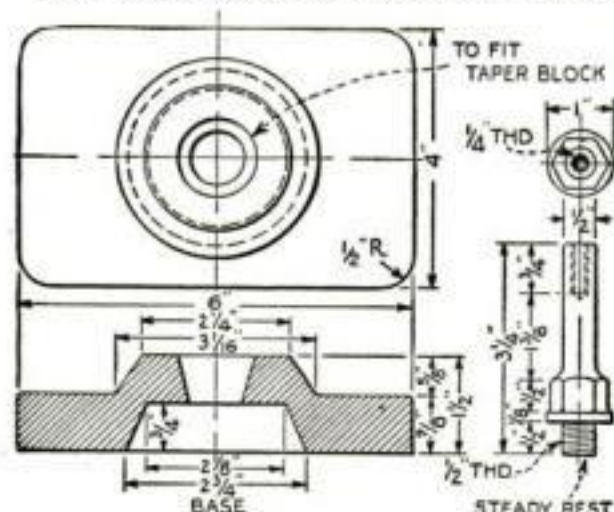
## To Dress Curved Grinding Wheels Truly

By Henry S. Laraby  
Toolmaker and Tool Designer

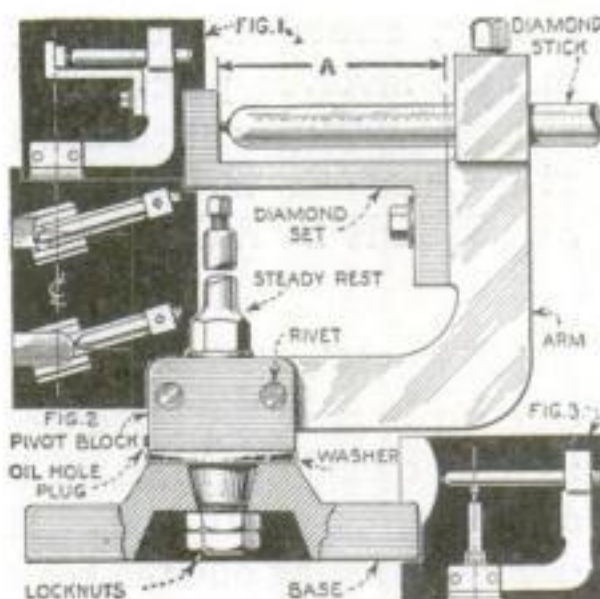
**W**HENEVER concave or convex surfaces are to be ground, it is a tedious, inaccurate and wasteful process to shape the wheel by hand with a stick diamond. The workman sometimes uses up nearly the entire wheel before the proper curvature has been obtained, and even then the grinding surface often is badly grooved because the diamond has been held by hand.

To overcome these difficulties and place the dressing of curved grinding wheels on an efficient basis, the dressing attachment illustrated was designed, and it has proved its value. With the constantly increasing use of grinding in the shop, it saves time and money; it eliminates all guesswork and immediately gives a concave or convex shape that conforms exactly to the shape to which the work is to be finished.

The construction is made clear in the

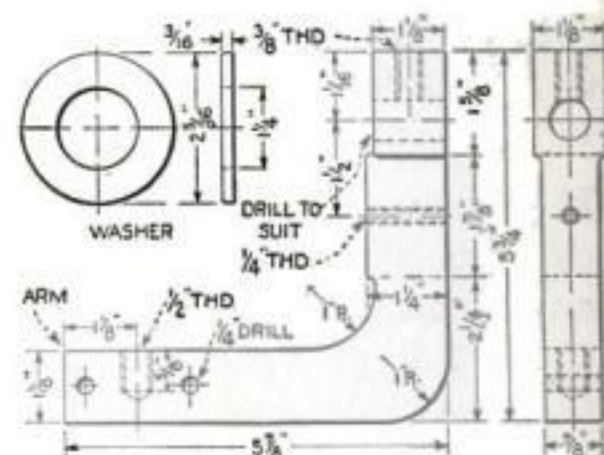
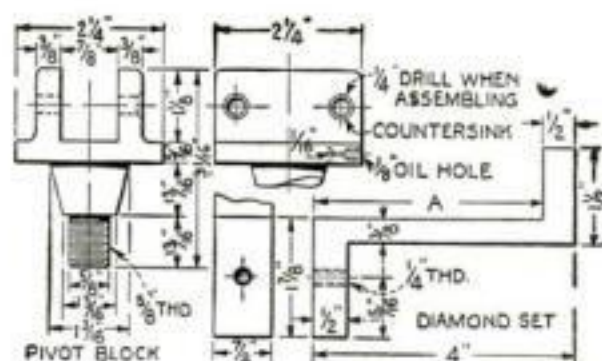


Details of the base, pivot block, arm, washer, diamond set, and diamond steady rest. All the parts are machine steel. The diamond set, which is hardened and ground, is used for setting the diamond accurately, and then is removed from the fixture during the actual process of dressing the wheel.



How the dresser is set up and used

accompanying drawings. A few words may be added, however, as to the use of the fixture. The diamond set fastens to the arm in such a way that when the diamond is flush against it, the point is directly over the center of the pivot block. When the point is located in any other posi-



## Micrometer Attachment and Variable Height Clamping Strap

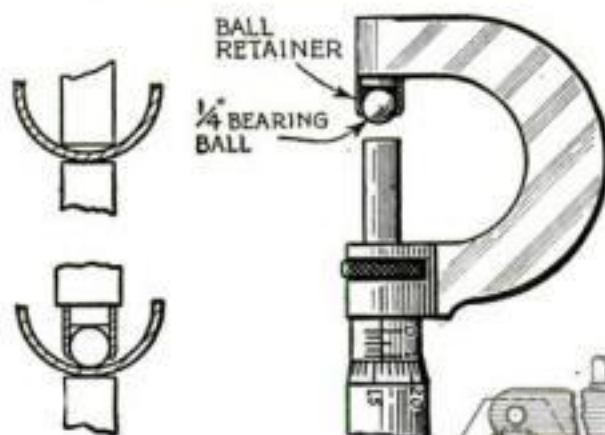
By C. M. Wilcox

**L**OOKING through a recent issue of POPULAR SCIENCE MONTHLY, the writer noted particularly a micrometer attachment used for setting dividers accurately. This suggested another simple and easily made "mike" attachment that allows an ordinary micrometer to be used for gaging the walls of metal cups, tubes, or irregular shaped pieces.

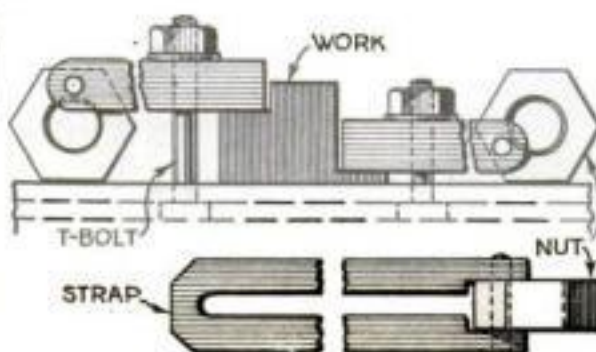
The attachment consists of a short length of light gage brass tubing and a  $\frac{1}{4}$ -in. bearing ball. The tube or ball retainer is reamed out so that it will slide over the micrometer anvil. It is crimped as shown, to prevent the ball from dropping out. Bearing balls come pretty close to size, as a rule, but it might be well to gage a number of them and select the most accurate. When using this attach-

ment, the reading is, of course, taken with the .250 graduation as zero.

With this attachment, an ordinary micrometer becomes a two-in-one tool; it serves for all ordinary purposes and, with the addition of the ball and ball container, measures accurately in awkward



The ball-anvil micrometer is shown above and the adjustable clamping strap at the right



places where it otherwise would be more or less useless.

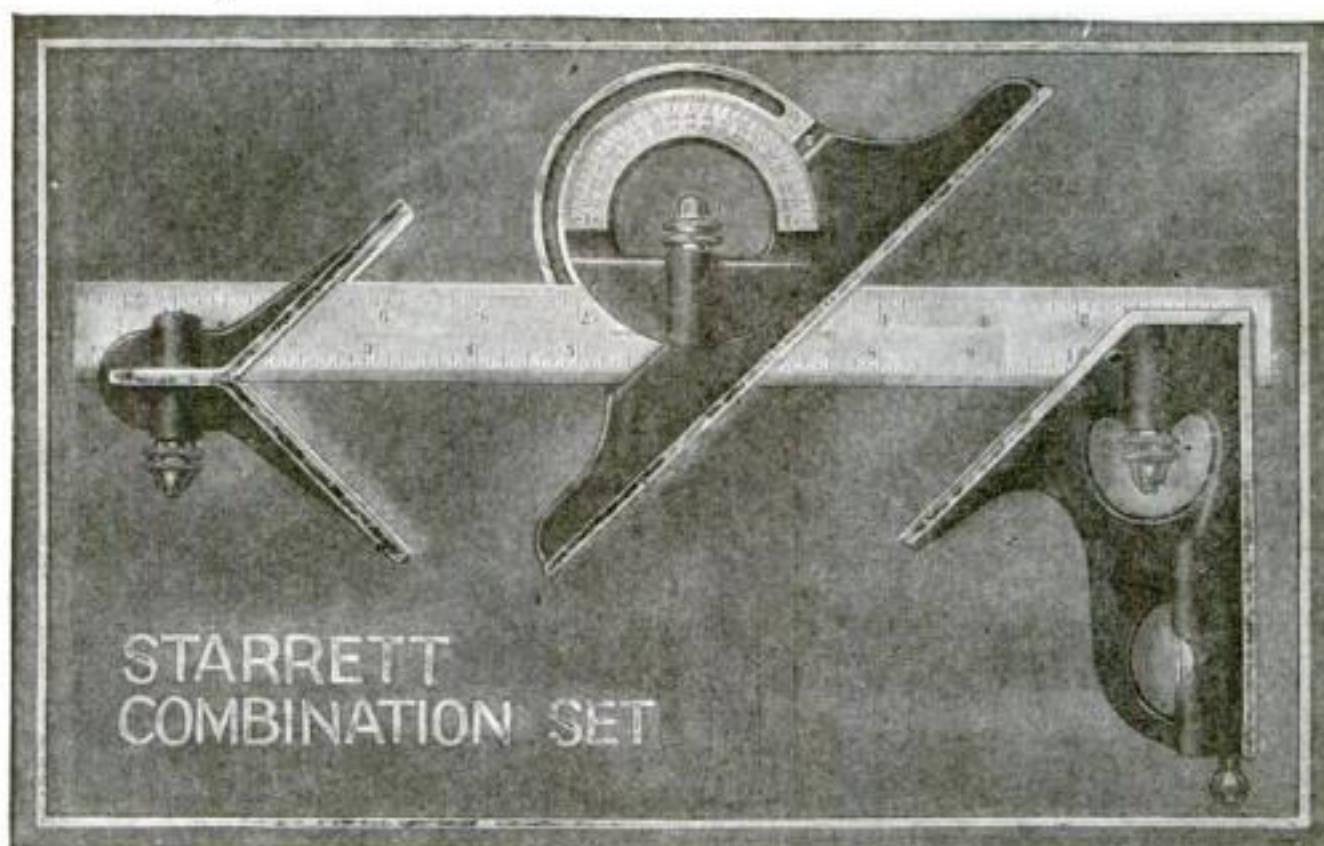
Another machine shop kink worth remembering is that a variable height clamping strap can be made of three parts—a hexagonal nut, a strap, and a hinge pin.

A long slot is provided in the strap to take the T-bolts used in the work table, and the end is yoked over the nut and fastened to it with the pin. Varying heights are obtained by indexing the nut and allowing it to rest on whichever one of its sides is the most suitable.

Fixtures made in this way avoid the necessity for hunting around for odds and ends of blocking to be used with the ordinary "jack" straps.

How to build a cheap but very efficient water still for use in auto and battery repair shops will be told next month. There will be helpful machine shop kinks by Joe V. Romig, Henry S. Laraby, C. M. Wilcox, and other experts.





## "The most useful tool ever built"

**Y**OU ought to own one of these famous Starrett Combination Sets. With its Drop-Forged Steel Combination Square, Reversible Protractor Head and the Center Head, here's a practical, handy tool that for general all-round work has yet to be equalled.

The Combination Square (with Spirit Level and Scriber in the Head) alone gives you seven tools in one—Rule, Square, Miter, Depth Gage, Height Gage, Marking Gage, Level and Plumb. Add the Protractor and Center Head, and you've got a set of accurate tools that you'll use constantly in a hundred and one different operations.

### *a few uses—*

#### **Machinists**

Laying out  
Bench work  
Leveling shafting, etc.  
Setting up machine tools

#### **Auto-Mechanics**

Lining up shafts, bearings, connecting rods, crank shafts, etc.  
Truing cylinders  
Checking up valve seats  
Timing valves

#### **Carpenters**

Laying out mortises, tenons, dentils, stringers, etc.  
Cutting rafters and jacks  
Scaling blue prints  
Leveling and plumbing jambs, casings, etc.  
Marking gage, rabbet gage, butt gage, etc.

And useful as it is, the Starrett Combination Set (No. 434 is illustrated) takes up but little room in your kit and saves littering the bench with the separate tools needed to do the same work.

Heads slide easily along the Blade and can be instantly removed or clamped at any desired position. All parts nicely finished, of the best workmanship and reliably accurate. For doing close work easier, you'll find the purchase of one of these Starrett Sets the best investment you ever made.

For complete description of the different Starrett Sets and Attachments, write for the Starrett Catalog No. 22 "W"

### **THE L. S. STARRETT CO.**

*The World's Greatest Toolmakers*  
Manufacturers of Hacksaws Unexcelled  
**ATHOL, MASS.**

5757 **Starrett Tools**







Where  
**ONLY A FILE**  
will do...

Mr. Handy Man, to keep the home shipshape,  
must have the proper assortment of files.

For instance: To smooth the edges on a warped door or to clean metallic surfaces before soldering—use a Half Round Bastard File. To fit stove linings—use a Cabinet File.

To sharpen knives and shears—use a 6" X-F Swiss Pattern File No. 2.

To sharpen a hatchet, axe or pair of skates—use a Mill Bastard File.

A Warding File will make a rusty key fit.

A Half-Round File will teach a window catch to behave. A Slim Taper File will sharpen a saw.

You need a Mill File for sharpening the lawn mower or garden tools. And by all means a Tungsten Point File for your motor repair kit.

You'll find every one of these Files in the NICHOLSON brand. Several in the NICHOLSON brand exclusively.

Sharpness, cutting-accuracy and edgeholding qualities are certainties wherever you see the NICHOLSON trade mark on the tang of a File.

Tell any conscientious dealer your purpose, and he'll select for you the NICHOLSON Files you need.

**NICHOLSON FILE ©**

Providence, R. I., U. S. A.

**NICHOLSON FILES**  
~a File for Every Purpose

## Old Bill Wins a Race in Assembling Pumps

By Joe V. Romig

**DO** YOU plan your work in detail, or do you rush headlong into a task, starting at the first angle that happens to strike your fancy? If you are still a young man, you probably follow the latter method, just as I did before Old Bill set me right.

It was while I was a machine hand that Old Bill, the layer-out, taught me the lesson that enabled me to grow, and I am presenting it in the hope that another may be lifted out of the rut by a bit of his wisdom.

Old Bill and I had been given the job of setting up two sand pumps, each consisting of a base in three parts, the two pump castings and their rotors and shafting, together



"Rather make your work right the first time than feel proud of your ability to repair a bull"

with stuffing boxes and bearings and a centrally mounted motor with couplings for driving the two centrifugal pumps.

As we started, Old Bill nudged me in the ribs with his crippled hand and said, "Joe, I'll get mine done before you do."

I took up his challenge and we started off, he going to the stockroom and I to locate my base sections. By evening I had the three pieces drilled, doweled, and bolted together, lying perfectly level on two floor parallels, while all Bill had to show for his day's work was a heap of castings and several boxes of bolts and nuts.

During that first day, as he passed me he would say, "Joe, you're working hard. Why, I haven't started yet!"

In spite of all my hustling, he was ready to pour his bearings as soon as I. Thereupon he offered to help me pour mine first, but I rejected his kind offer, being proud and foolish. Bill left to chin with an old crony until I should finish.

Upon his return he took one look at my work and then remarked, "You think you are still ahead, Joe, but really you are not. Your bearings are one sixteenth of an inch too low. Mine have yet to be done, but yours have to be done over."

Quickly I took up my foot rule and measured. Sure enough, Bill was right. I had not taken into consideration the shrinkage of the metal. Thereupon I doubled my pace, rushing to the stockroom for materials as I needed them, and often going two or three times for the same articles because I had not consulted the bill of materials.

All my haste was of no avail. Old Bill had his pump inspected and passed an hour before I tightened up my last bolt and nut.

After we had cleared away our tools and equipment, he called me over to his layout table and while fumbling over the blueprints

(Continued on page 86)



# The "B" Battery is the Life of Your Radio Set

THIS IS NUMBER ONE OF A SERIES

**T**HE only function of your Radio set is to produce sound-waves—those mechanical disturbances in the air caused by some rapidly vibrating body. So far as the Radio set itself is concerned the actual source of the sound is the "B" Battery. It is not an exaggeration to say that the "B" battery is the "life of your Radio"; for the set itself is simply a device to reproduce sounds, and the sounds all have their origin in the "B" Battery.

The "B" Battery is simply a box full of electrical energy; harnessed for you by experts. Without the Radio wave the flow of energy from the "B" battery is smooth, steady and *silent*. It is the final aim and purpose of all the many parts which go to make up a Radio receiving set, to convert the otherwise steady flow of electrical energy from the "B" Battery, into a rippling, vibrating, throbbing, audible current.

As the sound-waves—whether caused by the human voice in talking or singing, or by musical instruments—are modulated up and down—now high—now low; so does the current from the strongly vital "B" Battery follow the modulations and the variations, so that the original message, in all its delicacy of tone and vibration, comes clear and distinct through your Radio set.

Not a mere adjunct to the pleasure-giving quality of your Radio set is the "B" Battery—instead, it is the vital, life-giving part—the very heart of your Radio set.

Do not slight this vital part—give your Radio set the advantage of the best—use Eveready "B" Batteries.

*Note: This is No. 1 of a series of informative advertisements which will appear in this magazine. They are designed to help Radio users get the most out of their Batteries and Radio sets. If you have any battery problem, write to G. C. Furness, Manager Radio Division, National Carbon Co., Inc., Long Island City, N. Y.*



## The New Metal Case Eveready "B" Battery (No. 766)

*"The Life of Your Radio"*

The same popular 22½ volt Eveready "B" Battery in a new, handsome, durable, waterproof, metal container. Eveready quality throughout. At all dealers, \$3.00.

The "B" Battery is the vital part of any radio receiving set. Eveready Batteries—especially made for Radio—serve better, last longer and give better results.

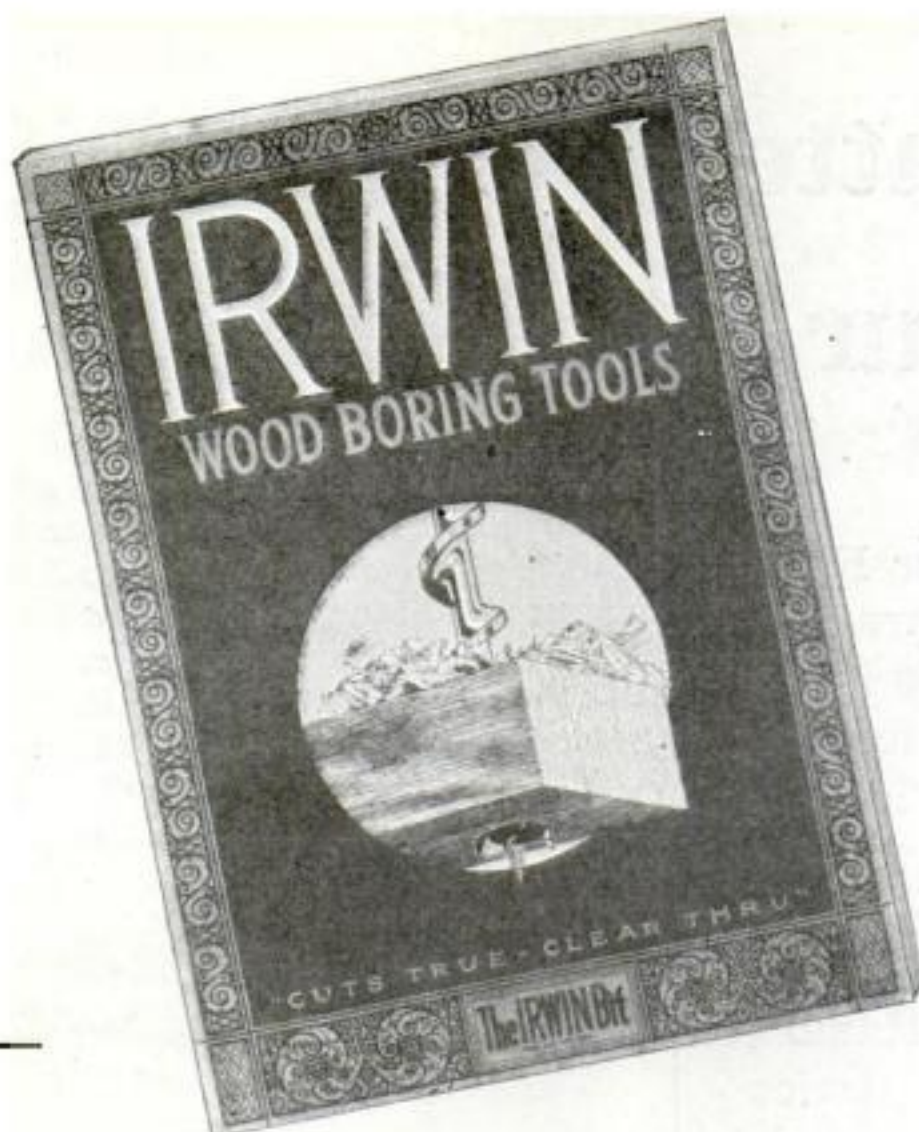
*Manufactured and guaranteed by*

**NATIONAL CARBON COMPANY, Inc.**  
Long Island City, N. Y.

**EVEREADY**  
**Radio Batteries**  
*—they last longer*



If  
You  
Use  
Bits—



## Send for this Book —it's FREE!

**WHEN** you bore holes you want the bit best adapted to the job,—the one that will bore the greatest number of holes with the least effort and least wear on the bit. No one bit is suited to *all* kinds of boring. Various kinds of wood, plus different boring requirements, obviously make necessary a corresponding difference in bits and augers to best meet those needs.

That's what this book tells about.

### It Gives the Answer to Many Bit Problems

It is filled with important facts about bits and their uses and tells how you can accurately select the right bit for any job of boring.

### It Tells—

- the essentials of wood boring.
- the various parts of a bit.
- about the cutting head of a bit.
- what makes the speed of a bit.
- the boring requirements of various kinds of wood.
- the comparative power required for boring different kinds of wood.
- how IRWIN Bits and Augers are made to meet those requirements.
- the reason for the uniform quality of IRWIN Bits and Augers.
- how IRWIN Bits and Augers are heat treated.
- about the IRWIN Bor Family.
- why different lengths and sizes of bits and various cutting heads are necessary to complete the IRWIN Bor Family.

- how the Bor Family is easily identified by the name of each member stamped on the shank of the bit.
- the length, size, and list price of all IRWIN Bits and Augers.
- how IRWIN Bits are put up in Sets for the greater convenience of bit users.
- how each IRWIN Borset is named to indicate the purpose for which it is best adapted.
- how IRWIN Borsets are packed in three styles of containers—the Borcase, the Borkit, and the Borchest.
- about the care of bits—how they should be resharpened, etc.
- about the IRWIN Trade Mark and what it means.
- about the IRWIN Guarantee Tag and what it means.

In short, this new IRWIN Booklet is practically a dictionary of wood boring tools and their uses, and should be in the hands of every man who uses bits. Get your copy NOW—it's FREE. Send TODAY, giving name and address of your hardware dealer.

**TO HARDWARE DEALERS:**—If you haven't received your copy of this new booklet, ask your Jobber, or write us, giving your Jobber's name.

Address Dept. 111

**The Irwin Auger Bit Co., Wilmington, Ohio**

CUTS TRUE

**The IRWIN Bit**  
Reg. U.S. Pat. Office

CLEAR THRU

### Old Bill Wins a Race

(Continued from page 84)

he delivered to me the most helpful lecture I have ever had the good fortune to hear.

His theme was, "Plan Your Work." He said it was his ability to plan that made it possible for him to compete with the younger and more active machinists. Instead of rushing blindly about trying to establish a time record, one should go about the work systematically. First, study the blueprints; know every piece and its location on the finished job; then study the material list, and you will have a mental picture of the entire task.

"Why, Joe," he said, "I pitied you when you carried all that material down here from the supply room. I did not carry even a washer. I loaded all the parts in a big box and had the crane bring it down. You made a dozen trips; I made only one. I reserved my strength for the work that could not be done with lathes, planers, and cranes, and there is enough of that. When I gave you a chance to babbitt first, you jumped at it, but tell me who cleaned out the forge, who hauled in a barrow of coke, and who hunted up all the ladles around the shop. You worked entirely too hard. If you used my methods and short cuts and added your energy, you would soon be foreman of the shop. Now, listen, Joe, if you are ambitious and really want to succeed, don't work quite so hard and use your head a little more. Make the machinery do the work, as I do."

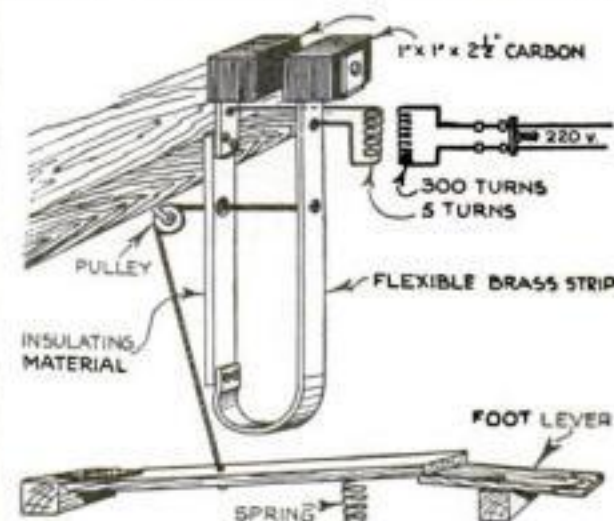
As we put our tools away and washed up, he gave me a last bit of advice, which was, "rather do a job right the first time than feel proud of your ability to repair a bull."

I had learned from Old Bill, in one short day, more than I should have learned in a year if left to myself.

### Electric Machine for Soldering

**I**N AN electrical shop or any other place where much small soldering has to be done, a simple electrical soldering machine may be made.

The secondary of an air-cooled dry-type transformer is connected with two carbon electrodes, the backs of which are copper-plated. The transformer is mounted by

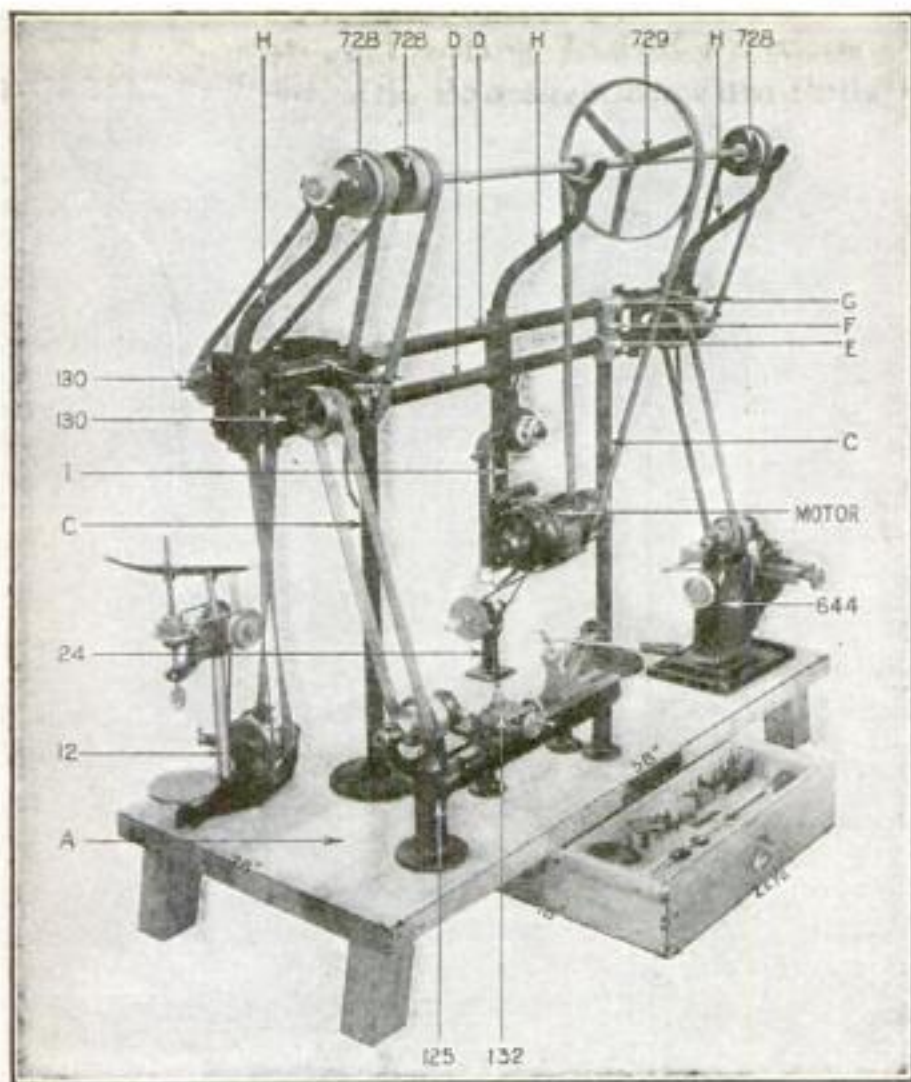


Pressing the foot lever unites the electrodes on work for soldering small parts in large quantities

means of iron straps fastened to the core. The primary winding is No. 10 double-cotton-covered wire, and the secondary No. 3 stranded rubber-covered, double-braid cable, wound as shown in the accompanying diagram.

The carbon electrodes are held in contact and therefore heat up whenever the current is on. Pressing the foot lever separates them to permit the work to be inserted.





### *What the Workshop consists of*

- (A) *Bench.* Dimensions 58" x 26" x 2". Legs 4" x 4".
- (B) *Superstructure.* Two cast-iron flanges 7" in diameter, 1 1/4" thick, bore 1" bolted to bench with four carriage bolts each 2 1/2" long.
- (C) Two pieces of XX heavy 1" iron pipe 28" long threaded at both ends.
- (D) Two pieces of 1" iron pipe 58" long.
- (E) Two 1" crosses.
- (F) Two 1" close nipples, double heavy.
- (G) Two 1" T's, heavy duty type.
- (H) Three offsets supporting jack shaft, forged out by a blacksmith and offset forward approximately 12" and upward 10".

*Motor.* One-quarter horsepower 1,700-1,800 revolutions per minute

- (24) G.-P. Polishing Head No. 24.
- (12) G.-P. Bench Drill, No. 12.
- (125) G.-P. Bench Lathe, No. 125.
- (132) No. 132 Slide Rest.
- (644) Milling Machine No. 644.
- (130) G.-P. Countershafts No. 130.
- (728) G.-P. Aluminum Pulley No. 728.
- (729) G.-P. Aluminum Pulley No. 729.

# Have your own Motor-driven Home Workshop

*You can make it easily now*

Turn your workshop into a mechanic's paradise! If you have electricity you can easily install this new Motor-driven Home Workshop—and at moderate cost.

Then you can construct all the things you have wanted to, whether in wood or metal, at a great saving in time, do all the work yourself, save money and have loads of fun besides.

Starting with the bench, superstructure, and a one-quarter horse-power motor, you can build up this Home Workshop with the Goodell-Pratt Tools listed at the left.

Any amateur mechanic will find in this Motor-driven Home Workshop a real education and a sound investment. It is not a toy, but a genuine practical apparatus that will last for years.

### *Send for free illustrated folder*

Get all the details of this new popular Home Workshop. Find out how reasonably it can be installed. Folder explains simply and clearly what to buy, the cost, and other details. A postcard will bring this folder.

### *Other Goodell-Pratt Tools you should own*

The Goodell-Pratt General Catalog No. 15 illustrates and describes the complete line of Goodell-Pratt 1500 Good Tools—each tool made by skilled toolsmiths for men who appreciate good tools. A copy will be sent free, on request.



GOODELL-PRATT CO., Greenfield, Mass., U. S. A.

*Toolsmiths*

# GOODELL-PRATT

## 1500 GOOD TOOLS





## Ask any radio expert

**T**HE first duty of a radio panel is to give satisfactory insulation, as any radio expert will tell you. The wise fan selects his panel with special care and insists on having one that supplies the proper insulation resistance.

Celoron Radio Panels provide satisfactory insulation under all conditions. They have high dielectric strength and great surface and volume resistivity, and do not warp or crack when exposed to moisture.

### Cut in standard sizes

For your convenience, Celoron Radio Panels come ready cut in eight standard sizes. Your dealer will hand you the size you want, and you can begin to build your set at once.

Celoron panels are easy to saw, mill, and tap, and will engrave evenly with-

out feathering. Each panel is wrapped separately in glassine paper.

Select from the following standard sizes the panel that suits your needs:

1—6 x 7 x 3/4	5—7 x 18 x 3/16
2—7 x 9 x 3/4	6—7 x 21 x 3/16
3—7 x 12 x 3/4	7—7 x 24 x 3/16
4—7 x 14 x 3/16	8—12 x 18 x 3/16

If your dealer cannot supply you, ask him to order, or write direct to us. Indicate by number the size you need. We also furnish Celoron in full-sized sheets and in tubes, and can cut panels in special sizes if desired.

### This booklet free

Write for a copy of our booklet, "Tuning in on a New World," which contains a list of the leading broadcasting stations in the United States and Canada, an explanation of symbols used in radio diagrams, and several efficient radio hook-ups. It will be sent to you free on request.

To radio dealers: Send for special dealer price list showing standard assortments

## Diamond State Fibre Company

BRIDGEPORT (near Philadelphia) PENNSYLVANIA

BRANCH FACTORIES AND WAREHOUSES  
BOSTON CHICAGO SAN FRANCISCO

Offices in Principal Cities

In Canada: Diamond State Fibre Company of Canada, Limited, 245 Carlaw Avenue, Toronto

CONDENSITE  
**CELORON**  
STANDARD RADIO PANEL

### Big Profits in 8 Hour Battery Charging

Small cash payment brings you **8 HOURS** charging outfit. Easy terms of only \$30 monthly let your profits pay balance with nice surplus besides. Thirty day free trial on money back guarantee. H.D. patented voltage-regulating winding absolutely prevents reversing. Saves current. You can easily clear \$150 to \$300 every month. Write today for information.  
HOGART BROS. CO., Box P11, Troy, Ohio

Small Cash Payment—Your Profits Quickly Pay Balance



### Print Your Own

cards, circulars, labels, tags, menus book, paper. Press \$12. Larger \$35. Job Press \$150 up. **CUTS EXPENSE IN HALF.** SMALL OUTLAY. Pays for itself in short time. Will last for years. Easy to use, printed rules sent. Print for others, BIG PROFIT. Write factory TODAY for press catalog, TYPE, cards, paper, envelopes.  
THE PRESS CO., D-33, Meriden, Conn.

## Build It Better—Quicker—Easier

Hundreds of users are doing ripping, mitring, grooving, rabbeting, tenoning, sanding, grinding and many other operations with speed and accuracy on the

### Boice Junior Bench Saw

A small compact, low cost, precision machine of all metal construction. Saws 1 1/2" stock with ease. Does 3/4" x 3/4". Easily driven by 1/4 or 1/2 h. p. motor or from line shaft. Top 10"x13" easily elevated for grooving or tilted to 10 degrees for beveling. Attaches to any light socket. Built of best materials; bronze bearings. Sold on guarantee of satisfaction or money refunded. Write today for descriptive literature on this and other Boice-Built Bench Machines and Motors.

W. B. & J. E. Boice, Dept. P. S. 11, Toledo, Ohio

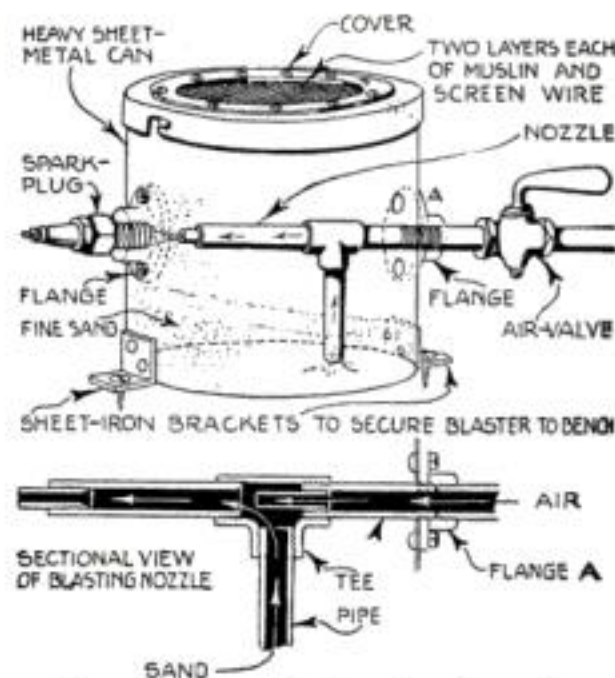


Machine as shown with guides and saw, . . . **\$28.75**

## Sand Blast Cleans Spark Plugs Quickly and Easily

**T**O CLEAN the carbon entirely from the porcelain of a spark plug is difficult even if the porcelain is removed from the shell, and in non-separable types of plugs it is even more tedious. The porcelain can, however, be cleaned thoroughly by sand blasting in a few seconds.

The illustration shows a fixture into which a spark plug can be screwed and the garage air supply used to scour the porce-



Phantom view, showing the cleaner in operation and section of the nozzle

lain with sand. The casing can be made from any heavy sheet metal can or box. Two flanges are riveted into the sides exactly opposite each other. One serves as a fitting into which a spark plug can be screwed; the other as an air connection.

Make a blasting nozzle of short sections of pipe and connections, as shown. The lower end of this T should be about 1/2 in. above the bottom of the casing. Cut out the top of the can or casing and rivet in place two layers of muslin between two layers of screen wire.

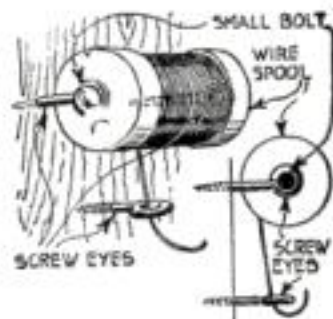
Place ordinary building sand to a depth of 3/4 in. in the bottom of the can, screw in the plug, and turn on the air. Renewal of the sand is occasionally necessary.

## How to Handle Spools of Wire in the Shop

**S**POOLS of iron, brass and copper wire, such as are commonly used in the shop, can be mounted conveniently by the use of holders made with three screw-eyes and a bolt. Two of the screw-eyes serve as brackets and through them passes the bolt, which forms a spindle for the spool. The third screw-eye acts as a guide for the wire.

The use of the holder prevents the loss of wire caused by spools unrolling when thrown together in a box or drawer. Each spool being set on a holder of its own makes it easier to find the size and kind of wire desired without delay.

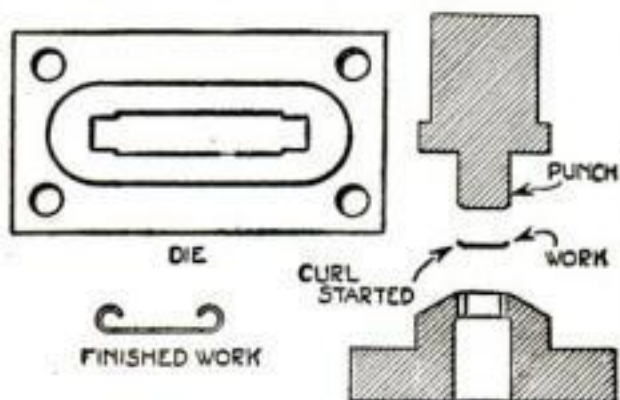
A FIRST-RATE metal polish can be made from clam or oyster shells. The shells are burned over a coal fire for half an hour and pounded to a fine powder.





## This Curl-Starting Blanking-Die Saves One Operation

THE curl-edged tin handles for cups are usually blanked out flat in the first operation, the curl started in another die in the second, and the curl finished in the



By beveling the punch, a curl is started at the first blanking operation

third. By beveling off the cutting face of the punch, however, the blank will have the curl started.

This does not affect the smooth cutting of the punch, and at the same time saves an operation.—S. A. McDONALD.

## Extending Small Drills

TO EXTEND small drills with a minimum of work, the method shown in the accompanying drawing may be used advantageously. Grind the shank of the drill to a triangular section and grind the end squarely across to make the corners so sharp that they will serve as a sort of



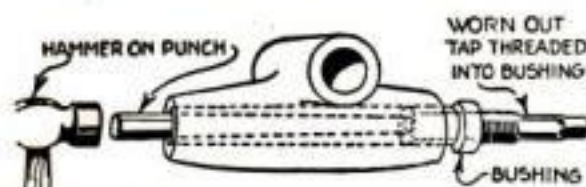
The triangular shank of the drill broaches itself into the extension

broach. Then drill the extension, which usually will have a taper shank, about  $\frac{3}{8}$  in. deep with a hole to make a snug fit for the drill. Extend the hole about  $\frac{3}{8}$  in. deeper with a drill  $\frac{1}{32}$  in. smaller.

The drill is then driven into the extension so that the three-cornered portion broaches three grooves, as shown. When the drill is worn out or breaks, it may be replaced quickly.—H. P.

## Extracting Worn Bushings

ALMOST every mechanic has experienced difficulty in extracting worn bushings from machinery of one type or another. The next time you are confronted with such a problem, obtain some old worn-out machine or pipe taps. Choose one of a



A discarded tap is used to plug the bushing

size to jam a thread into the bushing; in other words, a tap larger than the hole in the bushing, so that the tap will thread itself in. Then with a punch and hammer drive out the bushing.

The more worn the bushing the better this plan will work because the tap will crowd deeper into the metal.—J. R. S.

Trade Mark Registered  
**WURLITZER**  
200 YEARS OF MUSICAL INSTRUMENT MAKING

## Professional and Amateurs Praise Wurlitzer Instruments

"I am proud to be the owner of one of your new cornets. The tone, tune and valve action are positively superior to any I have experienced in all my years of cornet playing."

Harry L. Jacobs  
(Soloist with Sousa's Band, Brooke's Marine Band, Chicago Grand Opera)

"If I could not get another like it, my Wurlitzer saxophone could not be bought from me for \$200.00."

J. Russel David,  
Rockford, Ind.

"Without your credit system it would have been impossible for me to own this beautiful instrument."

Arthur L. Samp,  
Madison, Wis.



Any Musical Instrument

# On Trial

WURLITZER will send you *any instrument* for a week's trial in your own home. No obligation to buy—no expense for the trial—you do not risk a penny.

Wurlitzer instruments are known the world over for artistic quality and excellence of workmanship. Used by the greatest musicians, bands and orchestras. The house of Wurlitzer has made the finest musical instruments for over 200 years.

## Easy Payments

Payments are conveniently arranged in small monthly sums—a few cents a day will pay. All instruments to you at lowest factory prices. Special combination offers on complete musical outfits—velvet lined case, all accessories, self-instructor, etc—everything you need at practically the cost of the instrument alone.

## Send for New Catalog!

The greatest musical catalog ever published! Over 3,000 articles—every known instrument described and illustrated—many of them shown in full colors.

Wurlitzer has stores in over thirty cities, but no matter where you live, Wurlitzer is no farther than your nearest mail box. Send the coupon today!

The Rudolph Wurlitzer Co., Dept. 1788

117 E. 4th St., Cincinnati — 329 So. Wabash Ave., Chicago  
120 W. 42nd St., New York — 250 Stockton St., San Francisco

Send me your new catalog with illustrations in color and full descriptions of every known musical instrument, also details of the Wurlitzer Free Trial Easy Payment Plan. No charge, no obligation.

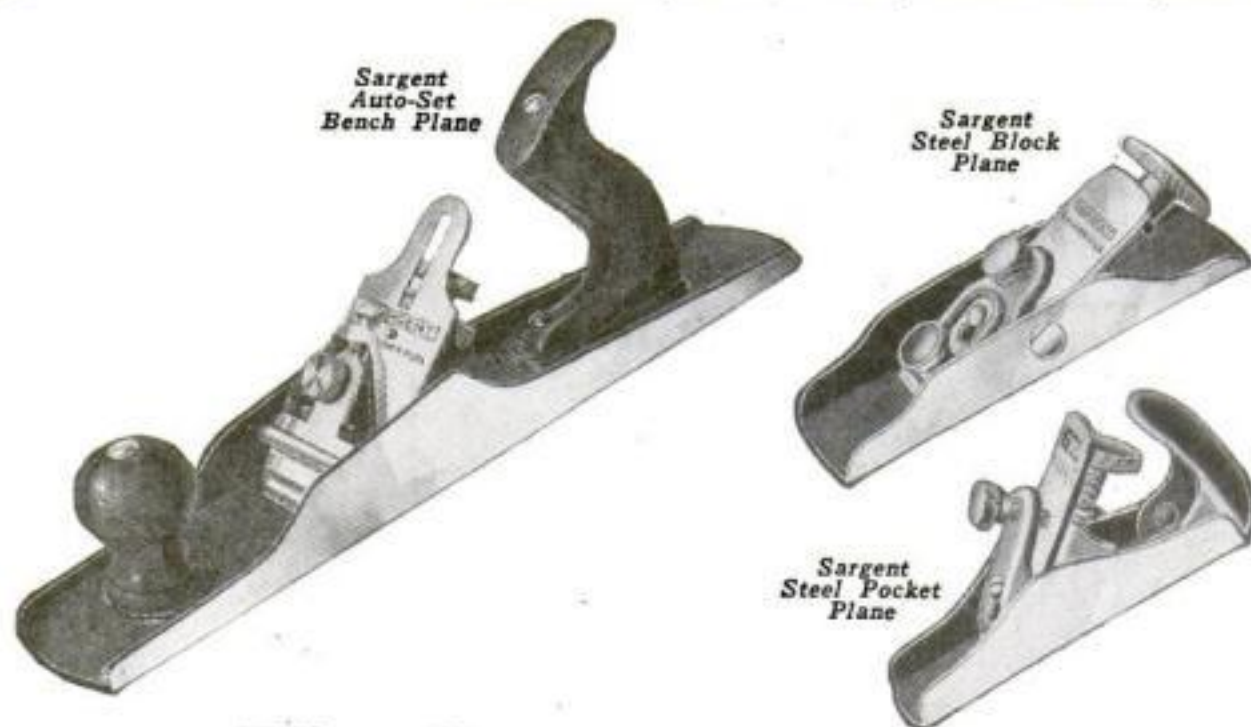
Name.....

Address.....

(State musical instrument in which you are interested.)

Copyright 1928  
The Rudolph Wurlitzer Co.





## The Cutter of Chromium Steel HOLDS ITS EDGE

**A**LMOST as sharp as a razor blade; even after considerable cutting! Zing!—with the grain, 'gainst the grain and 'cross the grain—feel the Sargent Auto-Set Bench Plane cut, smoothly and cleanly.

The diamond-like toughness of chromium alloy permits the use of a thin blade—and the thinner the blade, the keener the cutting edge. The advantage of a thin blade is also emphasized when it finally needs whetting. It is honed in a jiffy—replaced—and shaving away in short order, with the original adjustment unchanged.

For the finishing touches and working in restricted quarters, you need the Sargent Steel Pocket Plane and the Steel Block Plane. These smaller planes are indispensable to every workbench. They are light, handy, faithful—the tools of master craftsmen.

*Write for the Sargent Book of Planes. It's full of interesting information. And see these Sargent Planes at your hardware dealer's.*

**SARGENT & COMPANY**

*Hardware Manufacturers*

50 Water Street

New Haven, Conn.

**SARGENT**  
*Tools & Hardware*

**\$25.00 in PRIZES**

See top of page 6 in front  
of book for details

## LEARN RADIO

Get into the world's greatest field of profit and pleasure. Big money-making opportunities. Easy to learn. Trained men are in demand—mechanics, operators, designers, inspectors. Qualify for these high salaried positions, or make big money in your spare time. Unlimited possibilities on land and sea.

**I WILL TRAIN YOU AT HOME TO BE A RADIO EXPERT**

You, too, can learn, quickly and easily, to design, construct, install, operate, repair, maintain and sell all forms of Radio apparatus. No previous experience necessary. My methods are the latest and most successful in existence.

**FREE** Wonderful home construction tube receiving set, of the latest design. **Write Today** "Radio Facts" **FREE**

A. G. Mohaupt, Radio Engineer, AMERICAN RADIO ASS'N, Dept. 4 4513 Ravenswood, CHICAGO

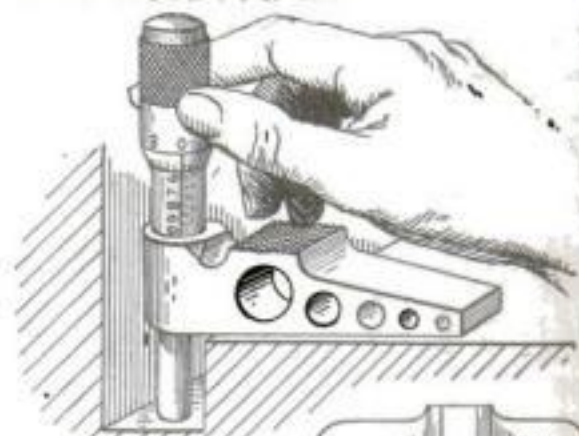


## Micrometer Head Used in Making Accurate Depth Gage

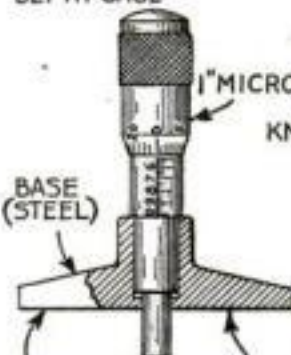
**B**Y USING a micrometer head, which can be obtained for a few dollars at any large hardware store, the machinist can make a handy and very rugged depth gage.

The base can be of either shape shown or modified in any way the maker desires. It should be made of good tool steel and as much of the finishing as possible should be done on a surface grinder. The lower surface is then lapped true on a lapping plate.

### MEASURING DEPTH OF SLOT



A CENTER BASE  
DEPTH GAGE



THIS SURFACE GROUND AND LAPPED

Combined with either a center or an offset base, a micrometer head serves as a useful depth gage



OFFSET BASE

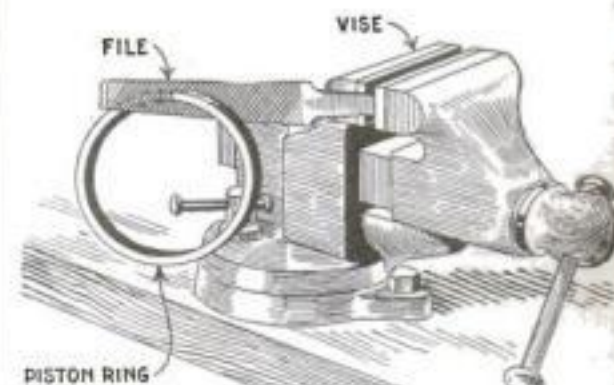
with fine emery powder mixed thinly with lubricating oil. Care should be taken to obtain an accurate, mirror-like surface.

The hole for the micrometer head is then bored by mounting the base piece on the faceplate of a small lathe and drilling and boring the hole for a light press fit over the end of the micrometer head.

The advantage of the offset head shown is in making measurements in corners where there is little room.—M. C. I.

## Fitting Piston Rings Quickly

**P**ISTON rings may be fitted more quickly than by the usual method of clamping the rings in the vise, by using a file



To save time in fitting, the file, instead of the ring, is clamped in the vise

clamped in the vise. Hold the ring with both hands and draw it along the file.

Since the ring has to be tried frequently in the top of the cylinder, this method avoids unnecessary handling of the vise and file.—L. A.



# Radio Catalogue Free—

**Write us  
a post card—**

**Address Dept. 5-R**

and we will send you free this 52 page catalogue of radio sets and parts. It also contains explanation of radio terms, map and list of broadcasting stations and much radio information, including an explanation of successful hook-ups and circuits.

You will be amazed at the low prices Ward's quote. A complete tube set having a range of 500 miles and more, including tubes, head set, batteries, and antenna equipment, as low as \$23.50.

This catalogue contains everything for the expert and amateur. Complete sets and every improved part for building sets, all the most up-to-date devices—at the lowest possible prices.

## Headquarters for Radio

Montgomery Ward & Co. is headquarters for Radio, selling everything direct by mail without the usual "Radio-profits." Why pay higher prices? Ward quality is the best and the prices will often save you one-third. Everything sold under our Fifty Year Old Guarantee,—Your Money Back if You Are Not Satisfied. Write today for your copy of this complete 52-page Radio Book.

**Write to our house nearest you. Address Dept. 5-R**

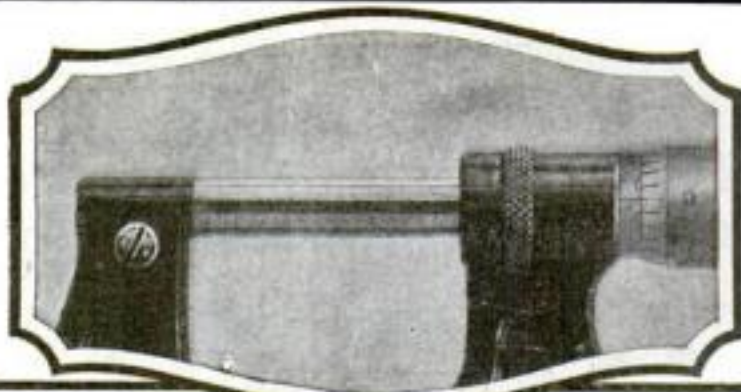
**Chicago    Kansas City    St. Paul    Portland, Ore.    Ft. Worth**

# Montgomery Ward & Co.

**The Oldest Mail Order House is Today the Most Progressive**







## The Accurate Fit of the Spindle and Anvil

### The third point of superiority of BROWN & SHARPE Micrometers

# 3

The three vital points of Micrometer construction which we have described are good reasons for the superiority of Brown & Sharpe Micrometers. You will find more valuable information in our booklet "The Micrometer." Write for it today.

The third point of superiority of Brown & Sharpe Micrometers lies in the accuracy with which the spindle fits in the frame and the squareness with which the measuring surfaces of the anvil and spindle come together.

The fact that Brown & Sharpe Micrometers have been giving faithful service for 30 and 40 years indicates the quality of material used and the accuracy of fitting the spindle in the frame and lapping the faces of the spindle and anvil.

The general appearance of Brown & Sharpe Micrometers together with the accuracy of the measuring screw, graduations, and measuring surfaces give every mechanic a Micrometer to be proud of and one that will give long, dependable service.

A close inspection of a Brown & Sharpe Micrometer clearly indicates the reason for its popularity with mechanics the world over.

Small Tool Catalog No. 28 describes the complete line of Brown & Sharpe Tools.

Write for a copy today

**BROWN & SHARPE MFG. CO.**  
Providence, R. I. U. S. A.

## BROWN & SHARPE TOOLS

How did  
your  
Garters  
look this  
morning?



## Boston Garter

### Velvet Grip

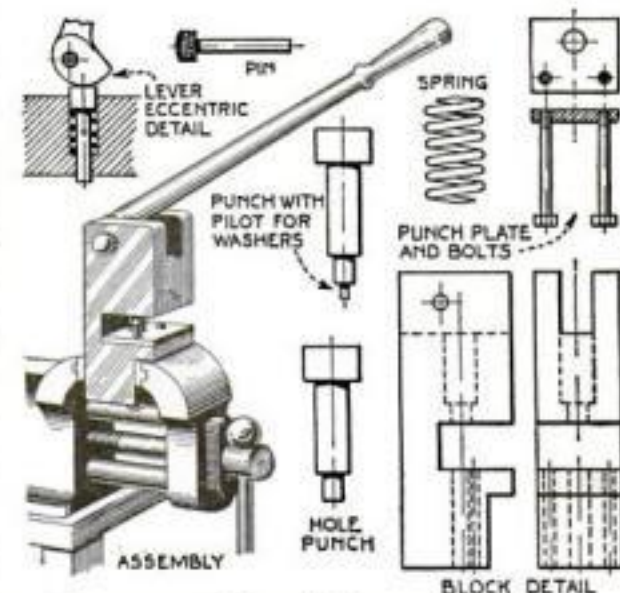
The new Wideweb "Boston" is light—cool—secure—adjustable—and rests so easily on the leg that you forget you have it on. See the new webbings in a variety of colors at your dealers. Insist on having the "Boston" because it is the only garter with the famous Oblong All Rubber Button Clasp.

GEORGE FROST COMPANY, BOSTON  
MAKERS OF VELVET GRIP HOSE SUPPORTERS FOR ALL THE FAMILY

## Hand Punch for Small Work Is Held in Vise

TIME and labor can often be saved in the shop if a small hand punch for the bench vise is available to handle work that cannot be done economically on a power punch.

The base of this small punch is clamped in the jaws of the vise and the lever pulled down by hand. Punches and corresponding punch plates are made to suit the work and can be changed readily. Two screws engaging tapped holes keep the punch plates



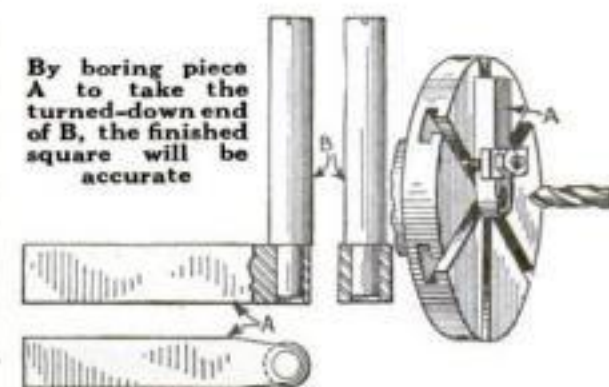
The vise punch ready for use and its parts

in place, and by removing the lever pin one punch can be substituted for another. When punches of large diameter are used for making up small washers, a removable pilot is screwed into the center of the punch, as indicated. Pilots of various sizes can be used with any one punch.

The base block and lever are forged steel and the cam end is hardened to resist wear. The lever is held by a removable pin, and a single heavy spring retracts the punch. All the punch bodies are the same diameter for interchangeability.—L. A.

## Making an Accurate Square

HOW to make a small square of tested accuracy with limited equipment in the shortest possible time is a puzzle to many new mechanics and perhaps some journeymen. It can be done, however, quite easily by using a piece of cold rolled



steel, of rectangular section, as at A, and a turned round piece, B.

Grind, file, and polish piece A, strap it to a lathe faceplate, drill a hole smaller than the turned down end of B and, with a small boring tool, bore out a hole for a press fit. This brings the hole dead square with the face of A, which is against the faceplate.

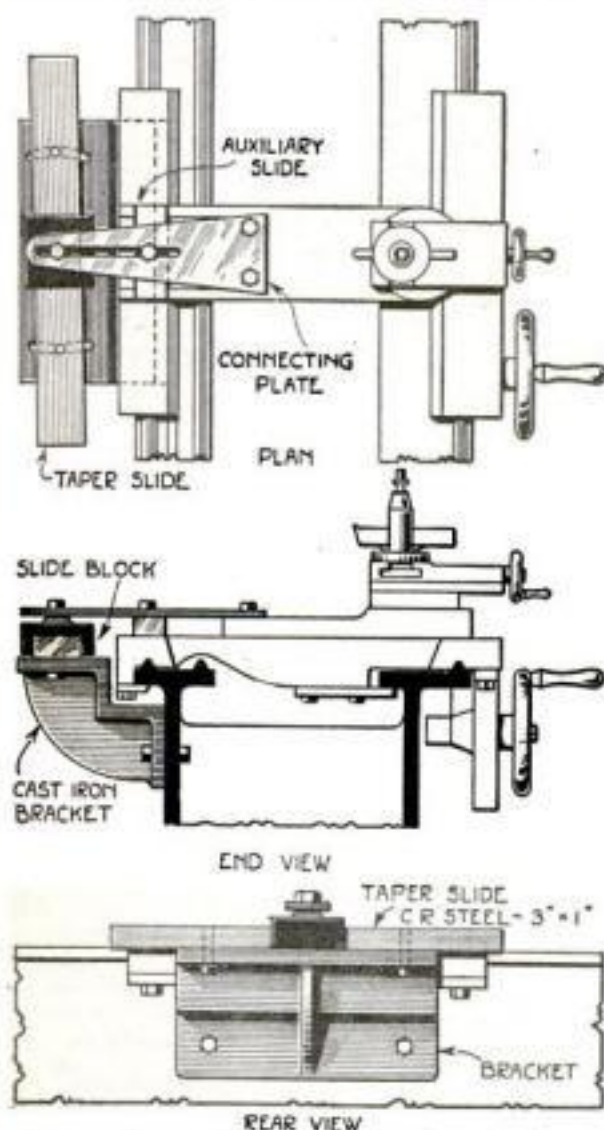
Since the piece B is generated on centers, it must be exactly accurate, so that when the two pieces are assembled with a light press fit, the square is certain to be exact, provided neither piece is bent or distorted.—W. BURR BENNETT, Scranton, Pa.



### Fitting a Taper Attachment on an Engine Lathe

LATHE owners doing taper work, and handicapped through the lack of the necessary attachment, can make at little cost a taper attachment that will answer the purposes of a commercial device.

The attachment consists of an angle plate bracket of cast iron, machined on the top face only, and a piece of flat, cold rolled steel, 1 by 3 in., with a rider slide, steel connecting plate, and an auxiliary slide for stiffening the connecting plate assembly. After being carefully checked for straightness and parallelism, the cold rolled steel piece is mounted on top of the finished surface of the angle plate, as



Three views of the taper attachment, showing how the parts are attached to the bed of an engine lathe

shown. The plate is tapped for cap screws that pass through radial slots in the angle plate. The builder can insert a central pivot pin, but that is not absolutely necessary.

The slide or rider block is cast iron, machined to fit the cold rolled steel bar. A connecting plate is shaped and slotted, as indicated, from a piece of  $\frac{1}{4}$ -in. boiler plate. This piece is bolted to the front part of the cross slide proper and, in order to stiffen it, an auxiliary slide is used.

Tapers appear on drawings either as so much taper a foot or in degrees. Work intended for the lathe is usually marked in the amount of taper a foot, and the taper attachment is easily set. Measure off 1 ft. on the machined surface at the rear of the carriage, and, with a scale and microscope, set the taper attachment slide accordingly to one half the total taper required.

For extreme accuracy in your work, an inside micrometer can be used for setting the slide. The turning of curved shapes and forms can be done by using a guide plate with the profile of the form milled in its top surface, and using a roller bolted to the connecting plate, running in the slot.

Ball shapes can also be turned for the center of universal trunnions.—J. R.

## Genuine "RADIOLA"

### Regenerative Receiver and 2-Step Amplifier

Made by Westinghouse Electric Company

for the **Radio Corporation of America**



**Only**  
**\$5.00**  
Down  
Puts  
it in  
your  
home

**N**OW everyone can have the finest radio receiver and amplifier that is made. No need to put up with inferior equipment. For here we are offering you the set designed by the great Radio Corporation, the highest authorities in the industry—and built by the Westinghouse Electric Company. It comes to you complete with all the accessories you need, for just a five-dollar payment. Take advantage of this new way of selling radio. Get an outfit that will give you permanent satisfaction. Send the coupon below for our Great Special Offer, made for a limited time only.

## The Perfected Radio —At Last

So simple to tune that it is just the thing for the beginner. Yet so perfect that it will delight the most hardened "radio fan" who has long been searching for the ideal circuit. Its long range will bring in stations never heard before, so loud and clear that a loud speaker will delight the whole family. Wonderfully selective. With it interference, internal noises and annoying body capacity are forgotten.

### WD 12 Tubes and Dry Cells Reduce Upkeep to Almost Nothing

Equipped with 3 of the latest type of dry battery tubes, WD 12 tubes use only  $\frac{1}{4}$  ampere. Most perfect tube both for detecting and amplifying. Battery expense reduced to the absolute minimum.

## Outfit Complete No Accessories To Buy

The radio outfits we sell are absolutely complete. Most others make an offer on the bare set and leave you to buy all the extras like tubes, phones etc. in addition. The outfit we offer you now includes, the Regenerative Receiver and 2 step Amplifier all enclosed in a solid mahogany case. Also the batteries, head-phones, tubes, aerial, lightning arrestor, and full wiring installation equipment. You start operating without investing another single penny. Your \$5 payment brings it all.

### Send Coupon for SPECIAL Offer Circular

Just mail the coupon. Get all the details without any obligation. Don't think of buying an ordinary set without finding all about this new and better way. Very easy terms. Free Trial. The highest quality of radio equipment possible to have.

**BABSON BROS.** 19th and Marshall Blvd.  
Dept. 13-68 Chicago

**Babson Bros., Dept. 13-68**  
19th St. & Marshall Blvd., Chicago, Ill.

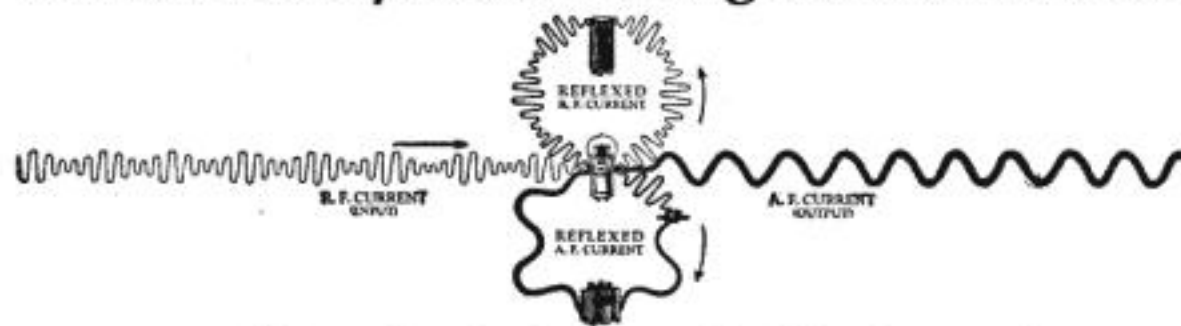
Please send me your special offer on a Complete Radiola Outfit on terms of \$5 down and monthly payments.

Name .....

Address .....



# Vacuum Tubes Do Triple Duty With Erla Synchronizing Transformers



Perfect synchronization of received and reflexed r. f. currents make Erla radio transformers indispensable in reflex work. List, \$5



Rectified radio frequency and reflexed audio frequency currents are accurately synchronized by Erla audio transformers. List price, \$5



Providing utmost sensitivity with perfect stability, the Erla fixed crystal rectifier is uniquely adapted for reflex work. List, \$1

Dealers and Jobbers—Erla scientific progress steadily opens new avenues of trade and profit. Write for our liberal terms and discounts

For the first time, the full efficiency of vacuum tubes is completely utilized and brought under control.

In Erla reflex circuits, tubes do triple duty, providing simultaneous amplification of radio frequency, reflexed radio frequency and reflexed audio frequency currents. Yet, so precise is the manipulation of this complex current flow, that the tremendous gains resulting are achieved without a single deterrent flaw.

Not only do Erla reflex circuits demonstrate decisive superiority in range and volume, but they are also unequalled in selectivity, purity of reproduction, and ease of control.

Even the single-tube circuit provides far-flung loud speaker range, while the three-tube circuit surpasses costliest multi-stage amplifiers in transcontinental loud speaker reception. And the two-tube circuit is but a step behind.

Essential to the operation of these circuits, and the secret of their success, are Erla synchronizing radio and audio transformers. Providing perfect synchronization of received and reflexed currents having the same phase characteristics, they assure tremendously magnified amplification without trace of instability or distortion.

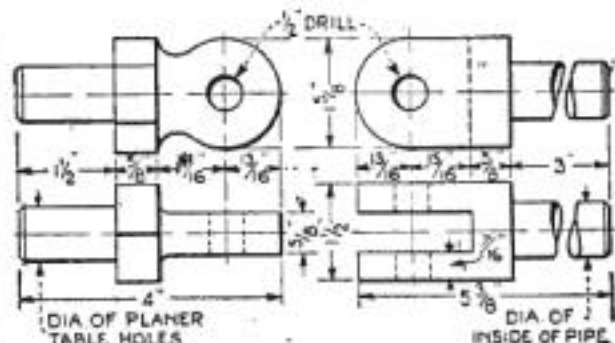
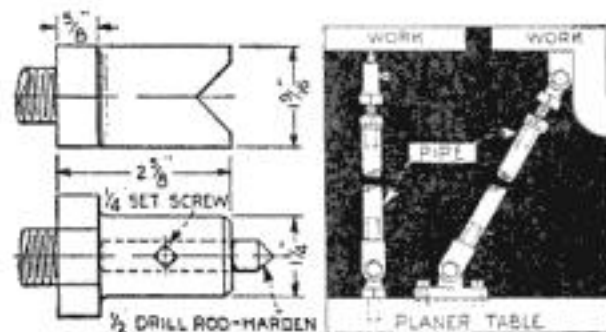
Complete working diagrams and descriptions of perfected Erla reflex circuits are set forth in Erla Bulletin No. 14, obtainable gratis from leading radio dealers. Or write us direct, giving your dealer's name.

Electrical Research Laboratories  
Dept. F 2515 Michigan Ave., Chicago

**ERLA**  
TRADE MARK REGISTERED

## How to Make Useful Planer Jacks for Heavy Work

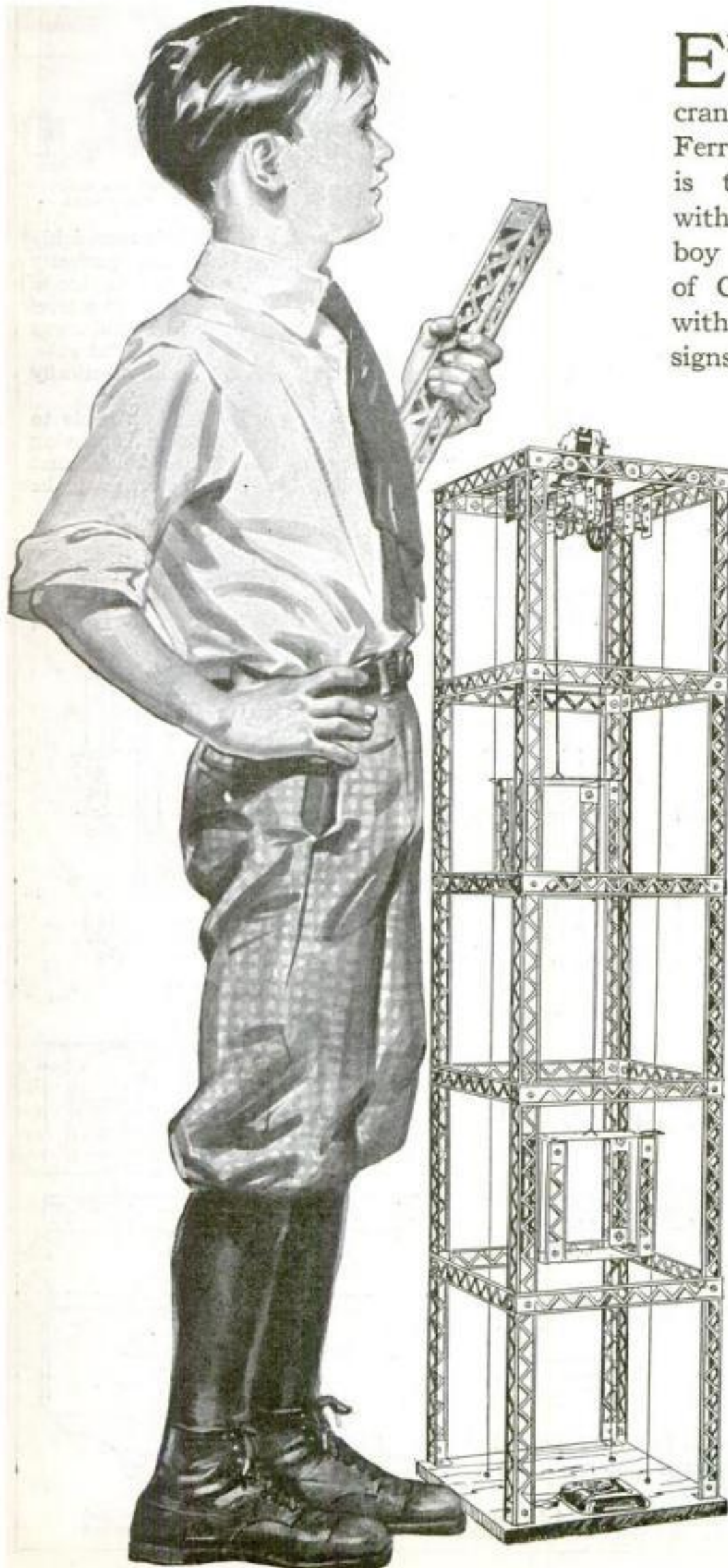
THE planer jack attachments illustrated below solve almost any kind of bracing or pushing problem that arises in heavy machine work. By means of a number of lengths of pipe or round bars bored out at





# ERECTOR

*The famous construction toy*



**E**RECTOR is the best fun in the world. Boys make wonderful bridges, cranes, derricks, windmills, railroad signals, Ferris Wheels and machinery. Erector is the only actual structural steel toy with four sided square columns. Every boy owning Erector is made a member of Gilbert Engineering Institute for Boys without cost. In addition to the many designs shown in the manual accompanying each set, he can win diplomas, honors and awards with original models.

THE A. C. GILBERT CO.  
New Haven, Conn.



Gilbert  
Erector  
No. 4

**\$5**

THE most popular set. It contains hundreds of parts and is also equipped with a sturdy electric motor to operate cranes, draw-bridges and machinery models.

SEND 10 cents to-day for Gilbert Year Book for 1924. Chock full of interesting articles for boys, chemical experiments, athletic sports, tricks, useful articles any boy can make, story of great engineering feats, etc., etc., as well as a complete catalogue of Gilbert Toys.

A. C. GILBERT COMPANY  
212 Blatchley Avenue,  
New Haven, Conn.

Enclosed please find 10 cents for which send me Gilbert Year Book for 1924.

Name .....

Address .....

City ..... State .....



## Makes Dumb Machines Speak for Themselves

**TWO QUESTIONS** your machine should answer:—

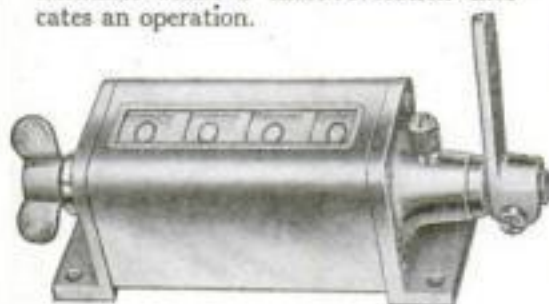
How much does it produce? It will answer you on a Veeder Counter.

How much *can* it produce? That also is indicated on a Veeder Counter.

Compare previous output with what you get after each development-step. That will guide you constantly to better results, *bigger production*—if your machine operates with a

# Veeder COUNTER

The Revolution Set-Back Counter below records the output of the larger machines where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, \$10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, \$11.50 (list). Smaller counters at prices from \$2.00 up.

### Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than 1/2 size.)

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at efficient speeds. Price, with two rubber tips (as illustrated) \$3.50.

**FREE**—The 80 page Veeder booklet shows every counting device an inventor or manufacturer could require. Let us send this free guide.

**The Veeder Mfg. Co.,**  
44 Sargeant St., Hartford, Conn.

## The Home Workshop, Continued

### How to Build a Mission Library Table

By E. E. Scott

**W**ITHOUT sacrificing any of the simple beauty of the Mission style, the desk-table illustrated combines the utility of both table and flat top desk. Ample drawer space is provided without making the table appear too heavy and cumbersome for the average living room.

Thoroughly seasoned quartered oak, preferably white, should be used throughout, except for the unseen parts and drawers, which can be maple or other hard wood. The table requires 33 board ft. of selected stock, planed on both sides. The stock can be cut to best advantage if five boards from 7 to 9 in. wide and 10 ft. long are obtained. For the legs, which are 2 in. square, it is not necessary to use quartered oak, as two of the sides will show practically a quarter grain if cut from an ordinary 2 1/2-in. oak plank.

The top should be glued up from the boards having the most beautiful grain and should be built up at first 1/2 in. larger all around than the finished size, which is 2 ft. 4 in. by 3 ft. 8 1/2 in.

It is worth while to prick punch the location for the dowelholes, and to take the boards to a shop where they can be bored or drilled absolutely true, unless the home

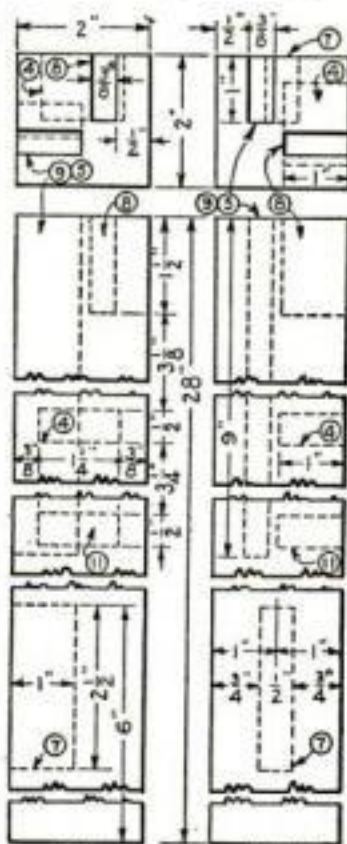


As a piece of living-room furniture, this Mission table has all the utility of a desk

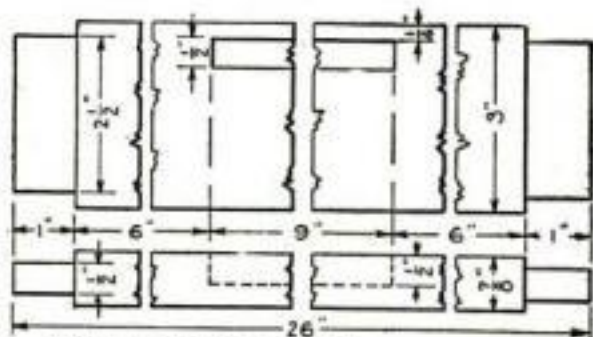
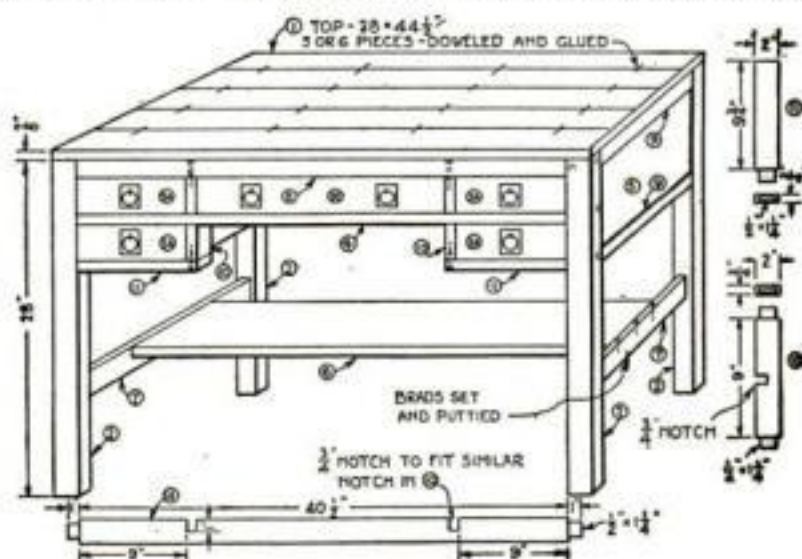
worker has a doweling jig or is thoroughly experienced in boring holes perfectly straight. Apply hot, freshly made glue to the edges and clamp the top up on a level surface, using cross boards and handscrews so that the piece will be perfectly flat when finished. The joints should be practically indistinguishable.

All the other parts should be made to the dimensions given in the accompanying details. The legs should be prepared first because of the number of mortises to be cut in them.

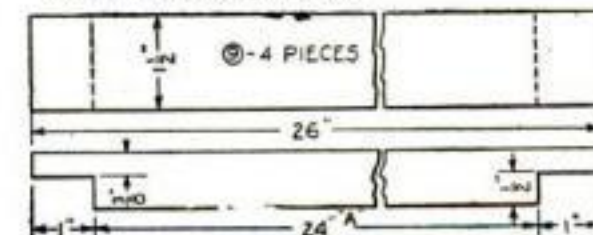
If the planes and chisels are kept sharpened to razor edge, it is surprising how easy it is to work accurately. Bore out as much as possible of the mortises with bits of suitable size. In laying out the legs,



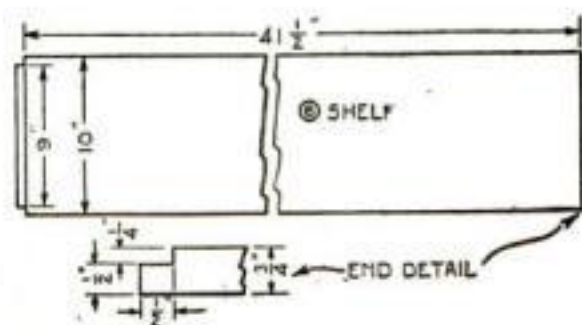
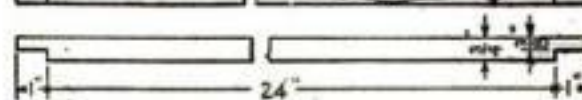
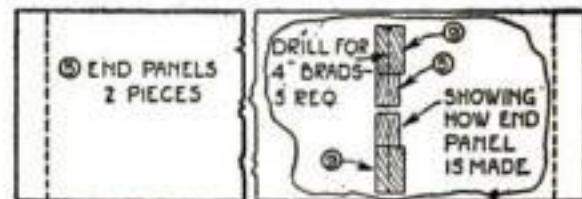
DETAIL SHOWING MORTISES FOR PARTS AS MARKED



⑦ SHELF SUPPORT—2 PIECES



⑧—2 PIECES SAME AS ⑦ EXCEPT DIMENSION 'A' = 40 1/2"



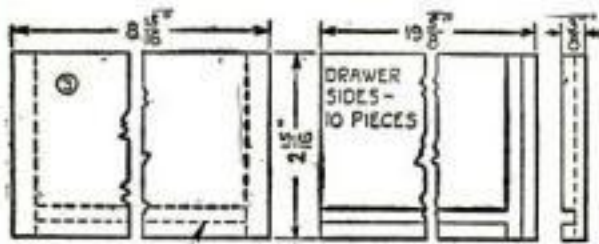
How the table is put together, and details showing exactly how to cut out the principal members of the frame and panels. Details and assembly are numbered to correspond



note that they are made in pairs, two left and two right. As the work progresses, every part should be fitted perfectly, even if the amateur's friend, a file, has to be called into service to insure close fits.

The first parts assembled are the end panels, consisting of two parts No. 9 and one part No. 5, glued and nailed together. Using one part No. 7 and one end panel, attach one pair of legs and repeat this procedure with the other parts of the same number. On the inside surface, which will be out of sight, put several  $\frac{3}{8}$ -in. dowels. Glue all surfaces in contact and dowel wherever possible.

Next, join two pairs of parts Nos. 4, 8, 10, and 11, using screws at the obvious points out of sight, as marked on the sketch of the assembled table. The set of parts that will be at the back should have parts 3B and 3D fitted into them and be glued and held with screws, taking care to set them in  $\frac{1}{8}$  in. to give the paneled effect. With the aid of the shelf, part No. 6, and the two previously assembled ends, join the whole framework of the table, dowel



GROOVES TO BE CUT AT MILL IF POSSIBLE

- ④-4 PIECES
- ④-4 " SAME EXCEPT 9" LONG FOR BACK PANELS
- ④-1 PIECE - 21 1/2" LONG
- ④-1 " - SAME AS ④ EXCEPT 21" LONG

How the stock for the drawers is cut out and put together

and glue it together, bind it with a few turns of rope, and allow it to set overnight.

The drawers should next be made and suitable pieces of maple fitted into the frame on which they will slide. As for the method of placing the drawers, a few minutes' inspection of a buffet or dresser will show just how this is done. For holding the various runs in position, it will be necessary to use eight iron angles. Note that the drawers are to be blocked at the back so that they will stop  $\frac{1}{8}$  in. in and form depressed panels when closed.

The top is put on by securing four  $1\frac{1}{2}$  by  $1\frac{1}{2}$  in. maple strips flush with the upper edge directly to the back of parts No. 8 and No. 9, using numerous heavy screws and glue. Turn the table upside down and put screws at 6-in. intervals through the strips and into the table top, but of course not clear through it. Use heavy screws and draw up the top tight by means of a screwdriver bit and brace. All that remains is to plane the top flush with the frame and scrape and sand it.

The finished table can be stained with any good commercial Mission stain, such as fumed oak, weathered oak, green weathered oak, or cathedral oak, coated with thin white shellac and finished with wax or a prepared commercial finish for Mission effects.

If one of the newer two-toned finishes is preferred, it can easily be obtained by brushing out the pores of the wood with a wire brush, applying a coat of stain, followed by a coat of thin white shellac and, when dry, brushing on a coat of silver gray, cream or other light toned, flat oil paint, (Turn to page 98)

# PROVED DURABILITY



## Nothing seems to hurt a Corona



THE downright toughness of this personal writing machine has always amazed its owners. Can you imagine any typewriter surviving a night's soaking in water?

George W. Warner writes from Salonica, Greece:

"Purchased in 1919, this Corona was banged all over the Balkans—averaging 50 kilometers per day. It spent a night under water in a submerged Ford that ran into a washout, and twice fell from pack saddles into rivers—but it always worked."

Another man dropped his Corona into seven feet of salt water, fished it out, dried it over his camp fire, and wrote 250,000 words before he saw a service station! For 17 years Corona has been meeting and surviving such tests of durability.

Probably you'll never abuse a Corona like this—but there's a lot of satisfaction in owning a typewriter that you know can be relied upon—under all conditions.

# CORONA

## The Personal Writing Machine

REG. U. S. PAT. OFF.

CORONA TYPEWRITER CO., Inc. GROTON, N.Y.

Mail the Coupon and learn how Corona can help you personally.

Please check or write below

- .... Doctor
- .... Engineer
- .... Farmer
- .... Manufacturer
- .... Office
- .... Retailer
- .... Selling
- .... Student
- .... Teacher
- .... Writer

CORONA TYPEWRITER CO., Inc.  
112 MAIN STREET  
GROTON, N.Y.

Please tell me how Corona can help me in the kind of work I have indicated.

Name \_\_\_\_\_

Address \_\_\_\_\_



The price of Corona is \$50 including a neat carrying case





**"Red Devil" Rapid Boring Bits** are 33 1/3% easier boring, have 10% greater clearance, and bore with or against the grain of any wood. Style 2400—10/16 in. shown here, 75c.

## A Giant's Grip



**"RED Devil" Pliers** put power and strength into your hand—a tenacious hold on that stubborn nut or bolt, that screw-eye you want to turn, that wire you want to cut, that rod you want to bend.

## Red Devil Pliers

Reg. U. S. Pat. Off.

—multiply the strength of your hand and wrist—they are your fingers of steel. Made in 100 styles—one for every purpose.

The name "Red Devil" on a plier is a pledge that it is the best of its kind made, that it is forged of tool steel and expertly designed and manufactured.

"Red Devil" Slip Joint Plier No. 1024—6 1/2 in., shown above, is a practical tool for all-around handiness. The slip joint increases its usefulness. Has thin nose for getting into close places. Screw driver in handle. Price, \$1.00 a pair at dealers or if not in stock, send dealer's name and order direct.

The "Red Devil" Mechanic's Tool Booklet shows the tools best suited for your needs—send for it—it's free.

**SMITH & HEMENWAY CO., Inc.**  
Manufacturers of "Red Devil" Tools  
264 Broadway New York, N. Y.

**"Red Devil" Glass Cutters**—the glaziers' standard tools of the world. "It's all in the wheel." Made in 40 styles. No. 024 shown here, 20c.

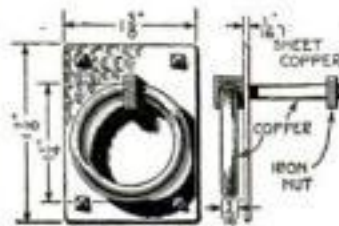


## Building a Mission Table

(Continued from page 97)

thinned with turpentine. When this has set for a few minutes, the surface is rubbed clean with a soft cloth. When the paint is dry, a dull finish varnish is applied.

It is advisable to shellac the drawers inside and out, after they have been fitted. Drawer pulls may be purchased or attractive ones made of copper, as shown. The beaten effect is obtained by laying a flat piece of copper on the bottom of a flat iron, an anvil, or the like, and denting it with the end of a bolt that has been slightly pointed with a file and rounded off.



The hammered drawer pulls

The rings are made by winding 3/16-in. copper wire spirally around a bolt or rod 7/8 in. in diameter and cutting off rings as required. The ends are then squared with a file and soldered together, after they have been passed through holes in copper bolts. These bolts are filed to the shape shown from strips 1/8 in. thick and 3/8 in. wide. It is not necessary to thread the ends of the bolts, for iron nuts will cut their own threads on them.

The square-headed studs that hold the plates in position are filed from ordinary copper tacks. Copper oxidizes quickly to a rich brown that harmonizes with the Mission finish.

## Homemade Glass Cutter Replaces Costly Diamond

A GLASS cutter that I have found to give better service than the common steel disk type can readily be made at home. All that is required is the wooden handle of an ordinary package carrier, a small amount of lead, tinfoil, solder, or other easily melted metal, and a carborundum crystal.



Carborundum crystals

The wire is removed from the handle and one end blocked up. The metal is melted in a crucible or other dish and poured into the wooden mold, which should be held with a pair of pliers.

Do the pouring with great care, as the metal will bubble quite violently for a moment. When the mold is full, insert a crystal of carborundum quickly while the metal is still liquid, and hold it until the metal sets.

Hold the finished glass cutter firmly and draw the point of the crystal over the glass with a slight pressure, as if it were a diamond glass cutter. It will be found that this quickly made device cuts very much like a diamond.



Mounting a crystal in molten lead

# ATKINS

## METAL CUTTING SAWS



Use Atkins "Non-Breakable" Hack Saw Blades

## End Hack Saw Blade Breakage

WITH Atkins "Non-Breakable" Hack Saw Blades you can not only eliminate practically all losses due to blade breakage, but also do metal cutting faster and easier.

These blades give remarkable cutting results. Made of selected steel, they are hardened and tempered by an exclusive gas and oil process which makes the cutting edge extremely hard and the body of the blade unusually tough and flexible. That's why they out-cut and out-last other blades. Prove it for yourself. Send us ten cents and tell us what metal you cut and we'll send a sample blade. You'll say it's the best you ever used.

### Saws for Every Use

No matter what wood or metal-cutting you do, there are Atkins' Saws to save you time, labor and money. Ask for our free booklets on the saws you're interested in.

## Get "Saws in the Shop." It's FREE



A 32 page book that's full of practical suggestions on metal-cutting, and general shop information. Every man who buys or uses saws will find it helpful. Send for it NOW. Just write your name and address on the margin of this page and mail it to us.

**Do It Now**

**E. C. ATKINS & CO., Inc.,**  
Dept. D-20, INDIANAPOLIS, IND.,  
Makers of Silver Steel Saws and Tools



# Ives Toys

## MAKE HAPPY BOYS

### TRAINS AND ACCESSORIES

**CUT THIS OUT WITH**

and mail to

THE IVES MANUFACTURING CORP.  
204 Holland Ave., Bridgeport, Conn.



I WOULD like to know how to build a model railroad. I enclose ten cents for which please send me your new, smashing 28-page book (thirteen beautiful pages in full colors) showing Ives Locomotives and cars, Ives fleet of Power Boats and Model Yachts. It will tell me all about the different electric and mechanical locomotives; parlor-cars, buffet-cars, mail-cars, freight-cars, oil cars, flat cars, semaphore signals, tunnels, stations, etc.

Please print name and address clearly.

Name.....

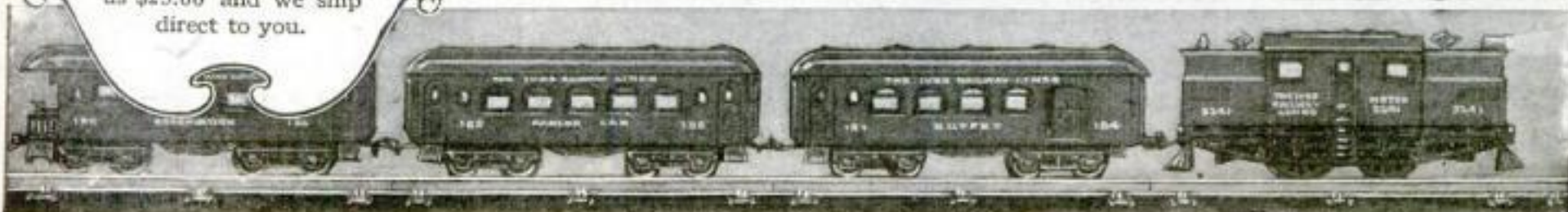
Address.....

City.....State.....

THE train illustrated below consists of a locomotive, Buffet-Car, Parlor-Car and Observation-Car; and 8 pieces of curved and 4 pieces of straight track, (2 Gauge, 2 1/4" from center to center) one terminal section, control switch and connecting wire.

This is a wonderful set to start railroading with. Go to your dealer today and ask to see Ives Train No. 701. If he can't supply you, send us \$25.00 and we ship direct to you.

*"Side-track that freight!  
Here comes the express!"*







## The only vise removable from base for continuous work

The "Yankee" Vise means more speed—greater accuracy. You don't have to remove work from vise until entire job is completed.

When you carry work from bench to drill press, to milling machine, and so on, simply lift vise, work and all, off base.

A "Yankee" Vise always assures perfect alignment; bottom, sides and ends are machined true.

Quickly released from base by turning set screw. Locks in any desired position by cam-throw lever at side. Hardened steel block, with V-shaped grooves, holds round or irregular work.

### "Yankee" Vises

with swivel base (detachable)

No. 1994—Body, 10½ in. long; 4 in. wide. Jaws open to 4 in.

No. 1993—Body, 7¼ x 2¾ (wide) x 3 in.; jaws open to 3½ in.

No. 1992—Body, 4¾ x 2 (wide) x 2 1/16 in. Jaws open to 1 15/16.

No. 1991—Body, 3¾ x 1½ (wide) x 1½ in. Jaws open to 1½ in.

Nos. 994, 993, 991. As above, without swivel base.

### Some other "Yankee" Tools

Spiral Screw-drivers	Ratchet Hand Drills
Quick-Return Spiral Screw-drivers	Ratchet Chain Drills
Ratchet Screw-drivers	Ratchet Breast Drills
	Ratchet Bench Drills

Dealers everywhere sell "Yankee" Tools

### Helpful Tool Book Mailed Free

Illustrates and describes all the ingenious "Yankee" Tools for saving time and labor. Write for copy today.



NORTH BROS. MFG. CO., Philadelphia, U. S. A.

# "YANKEE" TOOLS

Make Better Mechanics

## Our Blueprints Will Aid You in Building Christmas Presents

WHAT Christmas presents are you going to make this year in your home workshop?

Now is the time to plan. You will find many ideas in this month's Home Workshop; many more will be published next month; and there is the long list of POPULAR SCIENCE MONTHLY blueprints to draw



Thumbnail sketches of Home Workshop blueprints, except No. 8 and No. 28, the latter being illustrated on page 79

upon. This list is particularly valuable, for it contains designs of unusual attractive—  
(Continued on page 101)

### Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to provide, upon request, information relative to tools, material, or equipment.

Blueprint Service Dept.  
Popular Science Monthly  
225 West 39th St., New York

GENTLEMEN:  
Send me the blueprint, or blueprints, I have checked below, for which I inclose.....cents in stamps or coin:

No.	Title	Price
1.	Sewing Table	25c
2.	Smoking Cabinet	25c
3.	Book Trough End Table	25c
5.	Kitchen Cabinet	25c
6.	V. T. Radio Receiving Set	25c
8.	Shaving Cabinet	25c
9.	Arbor with Gate and Seats	25c
10.	Porch Swing	25c
11.	Bench and Tilt-Top Table	25c
12.	Electric Washing Machine	25c
13.	Tea Wagon	25c
14.	Toy Train, Horse, and House	25c
15.	Home Workshop Bench	25c
16.	Inlaid Radio Cabinet	25c
17.	Cedar and Mahogany Chest	25c
18.	Telephone Table and Stool	25c
19.	Grandfather's Clock	25c
20.	Flat Top Desk	25c
21.	Colonial Writing Desk	25c
22.	Girl's Cabinet and Desk	25c
23.	Pergola Garage	25c
24.	Gateleg Table	25c
25.	Sailing Outfit for Canoe	25c
26.	Baby's Crib and Play Pen	25c
27.	Kitchen Cabinet Work Table	25c
28.	Pullman Play Table	25c

Name.....  
(Please print)

Street.....

City and State.....

# No. 1052

## —a new Millers Falls Brace that takes large size bit shanks

IF your work calls for the use of expansive bits and other bits with large size shanks, here is just the brace you need—No. 1052 Millers Falls Brace.

The chuck is strong as Hercules and heavily knurled, to afford a good firm grip. The jaws are of the interlocking type, self centering, forged from steel and spring tempered.

Every carpenter and mechanic should have this brace in his kit. He will have plenty of chances to use it—and he will always use it with real satisfaction.

Ask your dealer to show you this new Millers Falls tool—No. 1052 Brace.

### Specifications:

Cocobola head and handles.  
Exposed metal parts polished and nickel plated.  
Chuck with interlocking jaws, for large size bit shanks.  
Ratchet—boxed.  
Head—ball bearing—full steel clad.  
Handle—Inserted metal rings.  
Sweep—10 inches.



Millers Falls Brace No. 1052

Interlocking Jaws—steel forged and spring tempered.

## MILLERS FALLS COMPANY

Millers Falls, Mass.

Manufacturers of Carpenters' Tools, Hack Saws and Automobile Tools





## Blueprints for Christmas Gifts

(Continued from page 100)

ness and utility for Christmas gifts. The sewing table, Blueprint No. 1, of which hundreds have been made, forms an always welcome gift for a woman. More elaborate and even more popular is the remarkably fine kitchen cabinet, No. 5. The tea wagon, No. 13, the cedar and mahogany chest, No. 17, the telephone table and stool, No. 18, the grandfather's clock, No. 19, the Colonial writing desk, No. 21, the gateleg table, No. 24, and the kitchen cabinet work table, No. 27, are all articles of furniture that make excellent gifts.

For the smoker, there is the smoking cabinet design, Blueprint No. 2, which is the equal of some of the most expensive commercial cabinets featured by exclusive Fifth Avenue, New York, tobacconists.

Blueprint No. 14 gives details of a toy train, kiddie horse, and doll's house, which make fine gifts for children.

A study of the list on the opposite page will show the wide variety of valuable gifts that can be made at home.

Each blueprint is a sheet 15 by 22 in., with complete working details, some of them full size, and an itemized list of materials.

## Prizes for Photographs

IF YOU have made or are making any article with the aid of POPULAR SCIENCE MONTHLY'S blueprints, don't fail to take a photograph of your handiwork. Then send us a print. We are always glad to see such photographs, and for each one considered worthy of publication we shall pay \$2. Address the Home Workshop Editor, Popular Science Monthly, 225 West 39th Street, New York.

## Polishing Turned Metal Work in a Small Lathe

WHEN a fine polish is required on a piece of plain turned metal, excellent results can be obtained by the method illustrated. A piece of flat spring is clamped to the toolholder of the slide rest in such a way that it exerts a light pressure on the work. The end of the spring is bent to conform roughly with the arc of the work and the extreme tip bent sharply down.



A spring holds the polishing pad in place

Between the end of the spring and the work is placed a pad of thick felt or a built-up pad of several thicknesses of soft cloth. The pad is charged with polishing material and is moved along the work by means of the slide rest.

The polishing material used at first will depend upon the quality of the tooling; that is, if the last cut was smooth and clean, a very fine polishing material can be used at once. For the final finish a little jeweler's rouge is excellent. The pad should be changed each time a finer polishing material is used to avoid scratching.

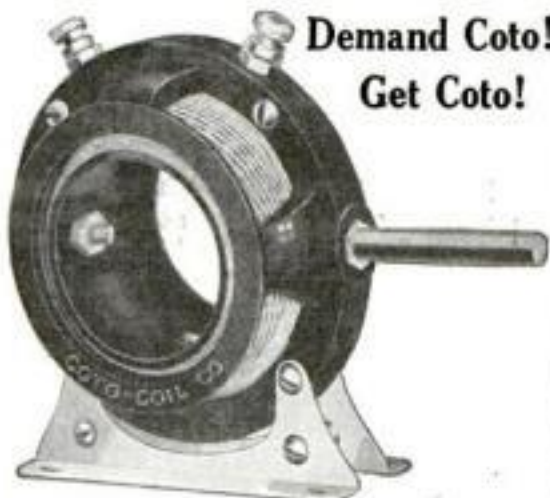
# Coto

"Built First to Last"

## Only the Set You Build Will Suit You

IF you have just half the soul of a real radio fan, a complete, ready made set will pall on you in a week. Build your own!

You want radio performance, to be sure, but you want it of your own creation. What so fascinating as to plan, to assemble, to adjust and construct? And finally to get the radio results and the set compactness made possible by this splendid line of distinctive parts—different and better.



Demand Coto!  
Get Coto!

## New Coto Compact VARIOMETER

Especially designed for new wave lengths, 200 to 600 meters and for the much demanded compactness. Size  $3\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$  in. In brown polished bakelite with honeycomb wound stator. Beautiful in action and appearance. Base or panel mount. Type 8000, \$5.00.

### Jobbers! Dealers!

The Coto line has the efficiency, the appearance and the advertising for big selling. Write at once for latest Price and Discount list.

## COTO-COIL CO.

87 Willard Avenue, Providence, R. I.

Pacific Coast Branch:  
329 Union League Bldg., Los Angeles, Cal.

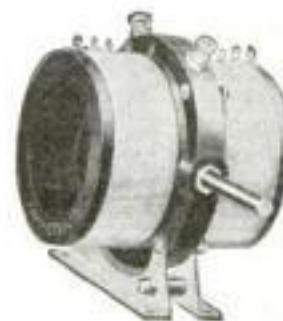
Northwestern Branch:  
Geo. F. Darling, 705 Plymouth Bldg., Minneapolis, Minn.

Southwestern Branch:  
C. P. Atkinson, Atlanta Trust Co. Bldg., Atlanta, Ga.



## New Coto Compact Vernier Condenser

Only  $2\frac{1}{4}$  inches square. Rotor plates soldered to shaft. Stator plates soldered at three points. .0005, \$5.00; \$6.00 .001.



## New Coto Compact Variocoupler

Twin sister of the Variometer. Size only  $3\frac{1}{4} \times 3 \times 3\frac{1}{4}$  in. Range 200 to 600 meters. Base or panel mount. Type 9000, \$5.50.



## Coto Special Audio Frequency Transformer

Turn ratio of 3 to 1. Coto quality throughout but made to sell at a popular price. \$2.50 Type 4500.



## The Original Honeycomb Wound Inductance Units

Popular low priced favorites of the amateur and experimenter. Descendants of the Coto Coils that guided the N. C. navy planes across the Atlantic. Sold mounted or unmounted.



## Coto Tapped Radio Frequency Transformer

Efficiently covers the whole broadcasting range because it is tapped. Just work the switch. Type 5000 A. \$7.50





## \$2500 REWARD for the Conviction of—

**Who murdered John Blake?** The country was stunned by the crime mystery of the year. A rich reward was offered. There were clues a-plenty. Circumstantial evidence pointed to a dozen men. But the District Attorney didn't dare bring any one of them to trial. Then the Finger Print Expert stepped in.

With feverish excitement the crowd in the courtroom listened. Judge, jury, attorneys and onlookers leaned forward in strained silence, eager to catch every word. The young Finger Print Expert in the witness chair was the center of attraction, as with calm assurance, he gave the evidence that convicted the murderer, and brought him the \$2500 reward.



### I Can Make YOU a Finger Print Expert

T.G. Cooke,  
President

I have trained hundreds of the men now prominent in the Profession. For instance, there's Harry Passano, Chief of the Iowa State Bureau. He had no previous experience—no college or high school education. He was just a country photographer. I trained him.

I can do the same for YOU. You may study right at home—in your spare time.

Right NOW is the time to start. More trained men are needed to fill the positions created almost daily. Salaries are high. Chances for big rewards are frequent. The Finger Print Expert is respected and deferred to by all. I am offering you a big opportunity. Will you take it?

### Professional Finger Print Outfit— Free

A professional outfit, just like the Finger Print Expert uses in court, in the laboratory and at the scene of crime, is yours FREE with this famous course of training. Also a course in Secret Service Intelligence is FREE to you if you enroll early. Mail the coupon for my free book telling all about the exploits of finger print detectives and full information about this wonderful profession, and your opportunity as a Finger Print Expert.

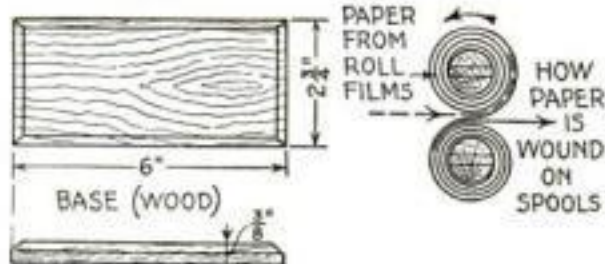
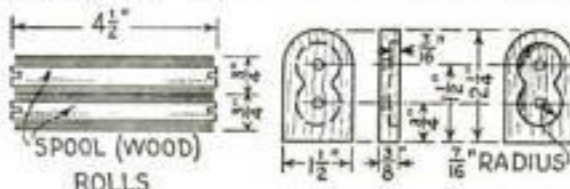
T. G. Cooke, Pres.  
University of  
Applied Science  
1920 Sunnyside Avenue  
Dept. 93-68, Chicago

#### PARTIAL LIST Graduates U. of A. S. Recently appointed Finger Print Experts of these States, Cities and Institutions.

State of Iowa  
State of Idaho  
State of Colorado  
St. Paul, Minn.  
Columbus, Ohio  
Detroit, Mich.  
Pittsburgh, Pa.  
Great Falls, Mont.  
Idaho Falls, Idaho  
East Lansing, Mich.  
Schenectady, N. Y.  
Lorain County, Ohio  
El Paso, Texas  
Galveston, Texas  
Houston, Texas  
Lincoln, Nebr.  
Everett, Wash.  
Ogden, Utah  
Butte, Mont.  
Pueblo, Colo.  
Albany County Penitentiary  
Albany, N. Y. (Mayor)  
Wilkes Barre, Pa.  
Livingston, Mont.  
Alhambra, Calif.  
Tulsa, Okla.  
Havana, Cuba  
Pensacola, Fla.  
Fort Collins, Colo.  
Calgary, Ala., Canada  
Indiana Reformatory  
Jeffersonville, Ind.  
House of Correction  
New Haven, Conn.  
Birmingham, Ala.  
St. Joseph, Mo.  
Marquette, Mich.  
Waterloo, Iowa

### Magic Printing Press Constructed with Old Photographic Film Rolls

THIS easily made magic printing press has offered much amusement to its owner and his friends. It differs from ordinary designs for the same toy because of its very smooth and mystifying action and its colorful accessories. Four Graflex film rolls,  $4\frac{1}{4}$  by  $3\frac{3}{4}$  in. in size, were wound on two spools in the direction indicated in the drawing. Since the paper is black on one side and red on the other, it was necessary to



A blank sheet of paper run through this "printing press" emerges with a picture

paint the red out with a dull finish black drawing ink. Any strip of tough paper can, of course, be used instead.

The spools are simply round rods, and the knobs ordinary drawer pulls. The brackets and base were made as shown and the whole apparatus assembled and mounted on a box, to which was added a length of coiled wire and a knob, pointer, and scale. The latter are simply dummies to add further mystery to the operation of the press.

In operation, a blank piece of paper is slipped between the rollers from the front and the knobs are turned. The paper apparently comes out on the other side printed, although, in reality, it has been rolled up unseen on the top roller, and another printed piece of similar width and texture has emerged from between the paper layers of the lower roller.

### Writing Ink Etches Permanent Mark on Steel Tools

SIGN your name or draw any mark on a polished steel surface with a fountain pen or an ordinary pen and writing or drawing ink, and the mark will be visible for many years, regardless of how much the surface of the steel is wiped. It does not give a conspicuous marking, but is sufficient to identify the tool.



Written initials will remain visible for years

A pair of shears with the date 1907 still bears the ink marks as plainly as ever. Marking over the same place several times will serve to make the impression more discernible.

This method of marking is also easy for tools and knives.—F. R. T.



### Let a Master Teach You Music

Learn to play for Pleasure or Profit without leaving home. Our simplified and complete courses are specially prepared for home study.

Celebrating 20th Anniversary  
with Special Tuition Rates

Be one of the first to receive the Anniversary Offer. Not a new method but one tried and endorsed by Paderewski and other great authorities as well as by thousands of students.

PIANO—CORNET—VIOLIN—HARMONY  
GUITAR—BANJO—MANDOLIN—VOICE  
PUBLIC SCHOOL MUSIC

Send today for Illustrated Catalog. Every person who loves music should read this free book. Write which instrument you have. Get details of the lessons and our Anniversary Offer—one which means a cash credit on your tuition. Careful training by Faculty in grading examinations makes the instruction personal for each individual pupil. See for yourself what others have done. You can be sure of the same results.

University Extension Conservatory  
825 Siegel-Myers Bldg., Chicago, Ill.

## WE TEACH COMMERCIAL ART

Meyer Both Company, the largest Commercial Art Organization in the World, offers you an unusual opportunity for practical training, based upon twenty-three years of success. This nationally known organization each year produces and sells to advertisers over 15,000 commercial drawings. Meyer Both instruction is the difference between successful fact and experimental theory. This well paid profession equally open to men and women. Home study instruction.

### Get Facts Before You Enroll in Any School

Ask the Advertising Manager of the leading newspapers in your city, anywhere in the United States, Canada, England or Australia about the Meyer Both Company—let them tell you about us. Write for our illustrated book telling about the success of our students—for one-half the cost of mailing—four cents in stamps.

MEYER BOTH COMPANY  
Department of Art Instruction

Michigan Ave. at 20th St., Dept. 35 CHICAGO, ILL.

Note—To Art and Engraving Firms: Secure practical artists among our graduates. Write us.

### Play this Jazzy Sax Without Practice

Any one can play this imported Jazzy Sax right away. No knowledge of music required, no lessons. Play by numbers instead of notes. All instructions and 15 songs free! The popular at parties, dances, picnics, entertainments. Glittering polished brass all over, except nickel mouthpiece. Looks just like regular saxophone. The same size.

Send No Money  
Send just your name. When the Sax arrives pay the postman only \$5.00 plus a few pennies postage. Play Jazzy right away. Guaranteed or money refunded. Don't delay, act now!

Supply Limited.  
FERRY & COMPANY, Dept. 1783  
75 W. Van Buren Chicago, Illinois

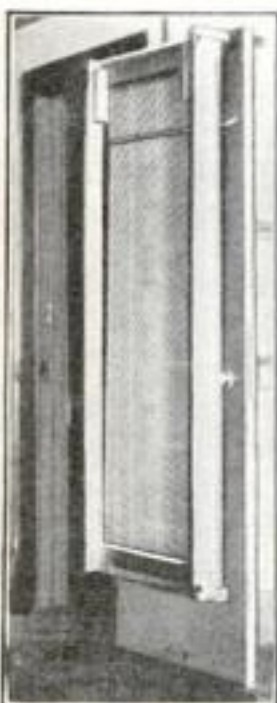
### Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous Frank Gotch and Farmer Burns offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book to—stating your name.

Farmer School of Wrestling 1788 Railway Bldg., Omaha, Neb.



### Couch for Emergency Use Hidden Behind Cupboard Door



The cot ready for use (above) and fastened behind the door (below)

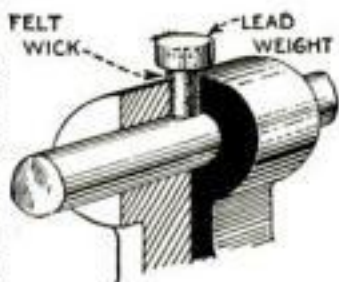
WHERE space for an extra bed or couch is lacking, as in a small house or office, an emergency cot can be hinged to the back of a closet door. It was to provide a couch in an office that the wardrobe bed illustrated was designed and built.

The bed frame was made a trifle smaller than the door of the closet. Hinges attached to the lower end permit the bed to be raised against the door and held in position by a rope hooked around it. Blocks hinged at the other end serve as feet and drop down when the bed is lowered.

The contrivance was made in an evening at a cost for material of only a few dollars and in several months it paid for itself many times.—FORD A. CARPENTER, Los Angeles, Calif.

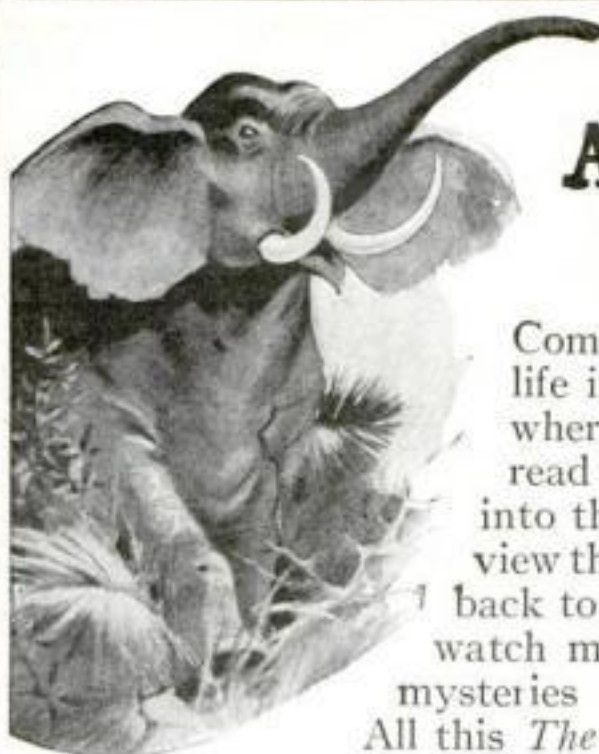
### A Self-Lubricating Bearing

A SMALL bearing that is hard to reach for lubricating can be made to take care of itself, often for months at a time, by the simple expedient of drilling an oil hole at the top much larger than usual, filling it with a piece of felt or wicking that fits rather loosely, and weighting the top of the felt with a recessed lead weight to keep it pressed down on the shaft. Once the wick is well soaked with oil, the lubrication of the shaft will be maintained automatically for a long time and there will be no dribbling of oil. Where the bearing wall is thin, it is a good plan to press into the oil hole a short piece of thin brass tubing to hold the wick.



While not new in principle, except perhaps the weight idea, this plan is one that amateurs seldom use and it deserves their attention.

PARAFFIN applied as an end coating for lumber during air seasoning will prevent much of the checking and splitting, as it retards the drying from the ends.



## The Most Amazing Romance Ever Written

Come out of the humdrum of daily life into a marvelous new world—where you can lift your eyes and read the story of the heavens, see into the depths of earth and ocean, view the activities of invisible life, look back to the dawn of the human mind, watch man as he solves the thrilling mysteries of life and time and space. All this *The Outline of Science* offers you, for it is

## A Revelation of the Secrets of Science The Free Book Tells You All About It



### The Wonderful Story of The Outline of Science In a Profusely Illustrated Story-Booklet FREE TO YOU

The interest in this epoch-making work has proved so intense that the publishers have prepared for free distribution a most interesting and strikingly illustrated brochure so that everyone may have the whole story of the most important publishing event in many years. With three plates in full color and over thirty half-tone pictures of scientific marvels, it shows how the four magnificent volumes of *The Outline of Science* describe the whole wonder-world of science. This fascinating booklet is yours free—send the coupon—no obligation and no expense.

### The Whole Thrilling Story of Scientific Progress

is in *The Outline of Science*—The Romance of the Heavens—The Story of Evolution—Man's Rise from His Earliest Ancestry—The Development of Races—The Fight to Live—Seeing the Invisible—Marvels of the Insect World—The People of the Air—In the Depths of the Sea—The Kingdom of the Animals—Wonders of Plant Life—The Body Machine—The Science of the Mind—Miracles of Electricity—Man, the Flyer—The Amazing Wireless—The Story of Chemistry—and many more, all told in terms so simple that anyone can understand, with a magnificent collection of nearly 1,000 superb illustrations.

The Coupon Brings Your Copy of  
the Free Booklet With Its Interest-  
ing Story and Fascinating Pictures

G. P. PUTNAM'S SONS, Publishers  
Dept. 136, 2 West 45th Street, New York

### This Coupon Brings the Free Booklet

G. P. PUTNAM'S SONS, Dept. 136  
2 West 45th Street, New York

Send me by mail, without cost or obligation on my part, the free booklet with three color plates and over thirty half-tone illustrations, describing *The Outline of Science*.

Name.....

Street and No.....

City and State.....

Occupation.....



# Great Fun for Boys from Four to Forty!



**L**ISTEN, Dad! Give your boy the real thing this year—a Lionel Electric Train. You will share his joy in operating it. It is good for countless hours of genuine delight, and instruction, too, for Lionel Electric Trains are exact miniature reproductions of actual locomotives and cars. Lionel stations, gates, signals, bridges, etc., are just like the most modern railroad equipment.

For your sake and his, be sure to get a Lionel. You will recognize Lionel's vast superiority by the substantial construction, the high grade of material used, the superb finish, the perfect operation, and the countless other refinements that always distinguish the **QUALITY** product.

**For 23 years Lionel has been the "Standard of the World."**

You can buy a Lionel Electric Train for as low as \$5.75, or you can buy a larger locomotive and track and add to it as you wish.

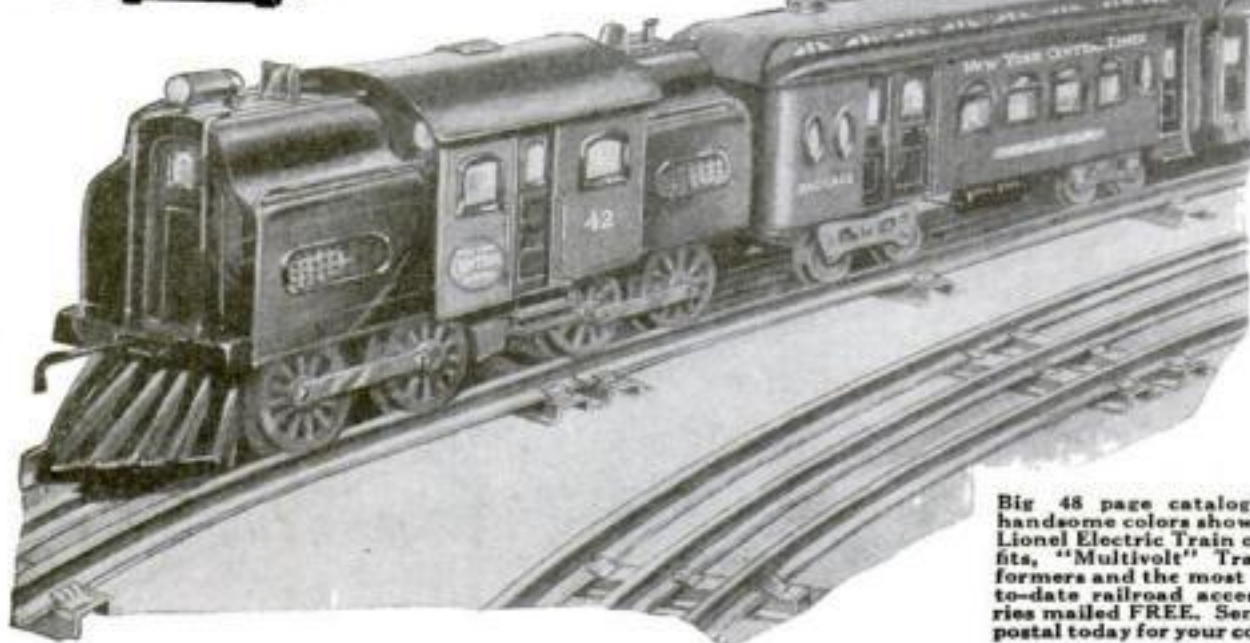
For sale at best Toy, Hardware, Sporting Goods, Electrical and Department stores.

**INSIST ON LIONEL—ACCEPT NO SUBSTITUTE.**

## Lionel Features

"Super-Motor" Locomotives, Pullmans with revolving seats and permanent interior lights. Electric Block Signals and Crossing Gate. "Lock On" Removable Track Contacts. Illuminated Bungalows and Villas for building Model Cities.

**The LIONEL CORPORATION**  
Dept. 15, 48-52 East 21st Street  
NEW YORK CITY



Big 48 page catalog in handsome colors showing Lionel Electric Train outfits, "Multivolt" Transformers and the most up-to-date railroad accessories mailed **FREE**. Send a postal today for your copy.

# LIONEL ELECTRIC TOY TRAINS

& Multivolt Transformers

## \$25.00 in Prizes

See top of page 6 in front of book for details

### Auto Goes 57 Miles Per Gallon



This marvelous device saves 25 to 50 percent of gasoline. Fits all cars. Agents wanted. Sample will be sent at our risk. Fill out the coupon and mail at once.

**COUPON**

**STRANSKY MFG. CO.,**  
510 7th Street, Pukwana, So. Dakota.

Gentlemen: Please send me full particulars about your wonderful Vaporizer.

Name.....

Street.....

P.O.....

State.....

### Learn to Mount Birds



Learn at home to mount birds, animals, game heads; taxidermy, make rugs and robes. Complete lessons. Easily and quickly learned by men, boys and women. **FREE** Book. Tells all about it. Every sportsman, trapper and nature lover should know this wonderful fascinating art. Save your trophies. Big profits. Success guaranteed. 75,000 graduates. Investigate. Write for Free Book. Northwestern School of Taxidermy 1788 Elwood Bldg., Omaha, Neb.



### A THRILLING CAREER

Become a reporter and news writer at home. Practical New York newspaper men quickly teach you this fascinating, well paid work. Personal instruction in Reporting, Writing for Out-of-Town Papers, Sports, Publicity, Society, etc. You can earn \$100 to \$400 monthly, part or whole time. Men and Women. Metropolitan School of Journalism, 60 East 42nd St., Dept. 110, New York, N. Y.

Become A Reporter! **FREE BOOK** Tells All

### Ideal Toolkit for the Farmer—Chosen by College Experts

**A**FTER a careful study of the tool requirements of the average farmer, the Department of Agricultural Engineering of the University of California, at Davis, Calif., has designed the exceptionally compact and complete kit illustrated. It meets all ordinary field requirements for repairs to



Weighing only 24 lbs., this portable kit carries the essential tools for farm machinery repairs

farm machinery and other farm purposes and yet weighs only 24 lbs.

The tools in the kit are:

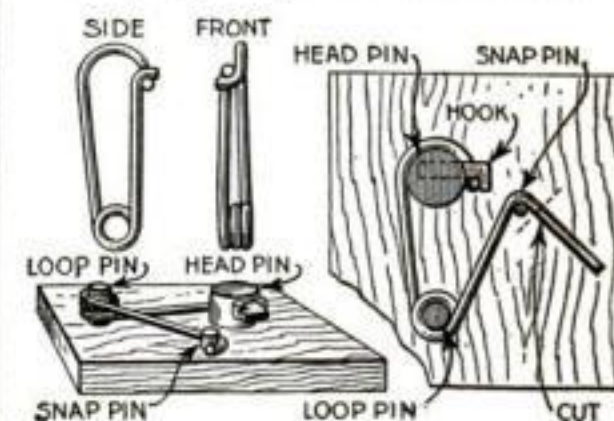
- 1-lb. ball peen hammer
- 6-in. extra slim three-corner file
- 8-in. round file; 10-in. mill file
- 6-in. screwdriver; 3-in. screwdriver
- Putty knife
- 7-in. by 3/4-in. chisel
- 8-in. by 3/4-in. punch; 6-in. by 3/4-in. punch
- 8-in. double calipers
- 3-ft. fourfold rule
- 6-in. slip-joint pliers
- 6-, 8-, and 10-in. adjustable end wrenches
- 14-in. pipe wrench; 12-in. monkey wrench
- 8-oz. oilcan and a grease can, with screw covers

The box, made in two halves hinged together, is 4 1/2 by 15 by 17 in. The stock is 1/2 in. thick, with the exception of the bottom, which is 3/4 in. Two 7-in. leather handles, one fastened to each section of the kit, are used. The hinges, hasps, and spring clips are standard hardware, but the guards for the ends of sharp tools and the various keepers are made of galvanized iron.

Bolts, nuts, and small extras are carried in a compartment 3 1/2 by 1 3/4 by 17 in. This is closed by a sheet iron cover divided in the center, hinged at each end and fastened in the middle by a loop and cotter key.

### Making Wire Snap Hooks

**U**SEFUL for many varieties of strap and leather work, this type of snap hook can be made in quantities from ordinary round spring wire, about 3/32 in. thick. A



The hooks are made quickly by bending spring wire around a simple form

block is fitted up with plugs, as shown, to serve as a bending form.

A right-angle bend is first made in the end of the wire. It is slipped under a hook fastened in the larger plug and carried down and around the small plug three times, after which it is taken up and around the snap pin and given a sharp right angle twist. It is then cut off as indicated. The bends at the ends prevent the hook from pulling open under a heavy strain. These snap hooks will replace buckles.—J. V. P.





# Keith Will Help You Build Your Home

Keith's splendid Plan Books and Keith's Magazine on Home Building aid you in the most important part of all—starting right. Don't begin your new home or even plan it until you learn about this service!

## The First Step in Building

**Y**OUR decision on the kind of house to build—how it shall be arranged—what materials to use—its general equipment and furnishing—all these things are simplified when plans and specifications are aided by Keith's practical and proven suggestions. Anyone who intends to build will be fascinated by the helpful pages of Keith's Magazine (a building authority for 25 years). Any requirements are met by the varied designs in Keith's plan Books—over 100 in each book. By special arrangement you may have the magazine regularly and all three plan books for a sum that is trifling compared to what you will get out of them. Read the offer!



One of the more than a hundred homes described pictures and planned in the Keith book of Bungalows.

consuming alterations.

If the first number of Keith's Magazine you receive is not a revelation—if your first glance through one of Keith's plan books does not make you enthusiastic—neither will cost you a penny. But to get

them, and use them will more than likely save you hundreds of times their slight cost. Now is the time to get them—under the special arrangement stated here. See offer and coupon.

## The Home You Want at the Price You Can Pay

The beauty of building on facts and figures gained through the Keith Corporation is the *certainty* that goes with it.

Keith designs are of proven practicability; the convenience of arrangement is known; materials and construction are those which experience



Attractive, but inexpensive cottage of which there are over a hundred in the Keith book of Cottages.

has already approved.

Yet, Keith-planned homes are decidedly distinctive. They are unique without being odd. There is artistry in their design, convenience and comfort in arrangement and appointment of rooms, whether it be a bungalow, cottage, or pretentious two-story house that you choose. Also, Keith plans work out to completion—without costly, time-

## Special Offer

Every number of Keith's Magazine contains home-building helps and home-furnishing suggestions worth while. We have arranged an eight-months subscription as a special introduction to new readers.

With this eight-months subscription comes a Keith Plan Book—whichever you choose—No. 1 is Bungalows, No. 2 is Cottages, No. 3 is Two-story Homes. If you desire all three, there's a further special offer of the set with a full year of Keith's Magazine.

Prompt use of the coupon below, accompanied by only \$2.50 (or \$4.50 for complete 336-plan offer) will help you realize your ambition to have a real home.

**KEITH CORPORATION,**  
101 N. 7th St. Building,  
Minneapolis, Minn.

I enclose \$2.50 for which send me Keith's Magazine for eight months, and also the plan book I have indicated by (x) in space below.

( ) Bungalows ( ) Cottages ( ) 2 Story Homes

OR

Enclose \$4.50 and we will send Keith's Magazine for a full year and ALL THREE plan books. Money back if you are not pleased.

Name.....

Address.....



## Make every room in your home COMFORTABLY WARM — and use less coal in doing it



### What the CROWN is

**T**HE CROWN fuel saver has no moving parts; never gets out of repair; does its work automatically; requires no attention.

The CROWN fits the feed door of any heating plant. It provides by means of natural draft, the supply of heated air necessary to burn the rich gases that rise from the fuel bed. These gases are ordinarily lost, going up the chimney as "smoke." The CROWN saves this unnecessary waste of fuel. This means a tremendous increase in heat and a corresponding reduction in smoke.

Write for details and price of CROWN—giving name and make of heating plant and approximate size of grate.

Steady even heat means health and comfort for the family. There's no need of shivering thru this winter. No need of jeopardizing health in chilly rooms when it's possible to have the whole house at an even comfortable temperature, using less coal in doing so and reducing the number of trips to fire the furnace.

Just put the amazing coal-saver and heat producer—the CROWN FUEL SAVER—on your furnace. You'll appreciate the difference in the atmosphere of your home. Never too hot. Never too cold. Just comfortably warm. There's nothing complicated about the CROWN. Any mechanic can attach it quickly and easily to the feed door of your furnace without injuring the door.

With the CROWN on your heating plant winter has no terrors. You get quick steady heat and plenty of it on the minimum of coal. You save at least 20% of fuel. One user says—"I have burned only half the amount of coal" (Name on request). With good reasons users are enthusiastic about the CROWN. The CROWN has met the test in severe New England winters—and has likewise kept homes comfortably warm in the "below-zero-blizzard-weather" in Montana.

A saving of 20 to 50 % in the amount of fuel burned means something. Figure it up on last year's fuel prices then decide if it isn't worth while to start that saving now.

Don't wait—don't delay. Write for details and price of CROWN asking for our informative booklet—"Making the Coal Bill Look Like 30 Cents." As the CROWN FUEL SAVER comes in 4 sizes—give name and make of heating plant and approximate size of grate.

### DISTRIBUTORS WANTED

Handsome profits and solid business future are assured CROWN distributors. Write for interesting proposition.

### CROWN FUEL SAVER CO.,

12 North Tenth Street,

Richmond, Ind.

## POSITION GUARANTEED

**I  
Want  
You**

The Finger Print profession wants men immediately. Big pay, interesting work, no lay-offs or shut-downs. I will teach you quickly to become a trained Finger Print expert. I guarantee a position and back it up with a \$1,000 bank deposit. Write at once for full explanation and details about my free Secret Service course, free Secret Service reports and special low price. Offer is limited. Write at once. No obligation.

U. S. SCHOOL OF FINGER PRINTS,

Dept. 13-68, 7003 N. Clark St. Chicago

**FREE**

## TYPEWRITER PRICES SMASHED.

**ONLY  
\$2<sup>00</sup>  
DOWN**

**A YEAR  
TO PAY**

**10 Days  
FREE  
Trial**



**SAVE OVER  
HALF**

of a beautiful Underwood, Remington, or Oliver. The world's best makes. Standard, full size machines with Universal Keyboard. Direct from rebuilder to you at tremendous saving.

Every machine fully guaranteed full ten years. Completely rebuilt from top to bottom, new letters, new platen, new key ring, newly enameled and nicked. Looks and works like a brand new machine. Equipped with back spacer, stencil device, automatic ribbon reverse, tabulator, two-color ribbon. All modern improvements.

**Send No Money**—just write for our big FREE Catalog showing all machines in full colors. Also brings full details of our direct-to-you easy payment selling plan.

**Big FREE Catalog** mailed immediately to those who act now. Don't lose a minute. Save over half if you write now.

**INTERNATIONAL TYPEWRITER EXCHANGE**  
177 No. State St. Dept. 11-49 Chicago, Ill.

## \$50 to \$100 a Week

—and much more is being made by many of our 4000 Paul men demonstrating and selling—

### AIR-GAGE Inner Tubes

—greatest improvement ever made. Air Gauge in valve stem of every tube shows pressure at a glance. Build a profitable and permanent business of your own. Experience not necessary. We teach you how to sell and give exclusive territory. Free book explains all.

PAUL RUBBER CO.

Dept. 64, Salisbury, N. C.

## \$25.00 in PRIZES

See top of page 6 in front of book for details

## FREE To Boys

We give these premiums and many others to boys absolutely free—without competition or contest—just for being agents to sell The Saturday Blade, Chicago Ledger and Lone Scout.

It's easy to deliver our papers to weekly customers and to get new customers. Only a little time on Fridays or Saturdays required.

### Steady Money In addition to Premiums

Our Agents earn from \$1.00 to \$5.00 a week in cash. It does not cost a penny to start. You sell the papers to weekly customers and take your money out. This money is in addition to the valuable premiums we give. Do not miss this chance. Just write us a letter or postcard and say "I will be Agent for your papers in my neighborhood." No risk—you cannot lose anything—you send us no money until you sell the papers. We tell you how to get customers.

### W. D. BOYCE COMPANY

500 N. Dearborn St.,  
Dept. 209, Chicago, Illinois





## Loop of Cord Will Tame Your Camera Tripod

A HAPPY group, a shady spot, and a snapshot click of the camera! A few days later the pictures are delivered, but those that should have contained the greatest interest—the subjects snapped in the shade—are dark and murky. In other words, those films are nearly transparent or underexposed.

With the average camera and lens, snapshots of 1/25 second and faster are only possible when the subject photographed is sufficiently illuminated by direct sunlight. Amateurs are realizing this more and more



With this safety cord in place, there is absolutely no danger of the tripod's slipping

and are looking to the tripod not as a nuisance or as professional equipment, but as a necessary adjunct of the hand camera.

Tripods have a habit, however, of slipping when least expected, especially on smooth pavements and concrete roadways. The illustration shows a simple, inexpensive, and reliable method of keeping the tripod legs where they belong. I have used the scheme for several years, but it appears to be new to every one I have shown it to. The brace is simply a loop of heavy twine or cord. When the tripod is set up, the loop is slipped over the legs; the thumbnails on each leg prevent it from slipping to the bottom.

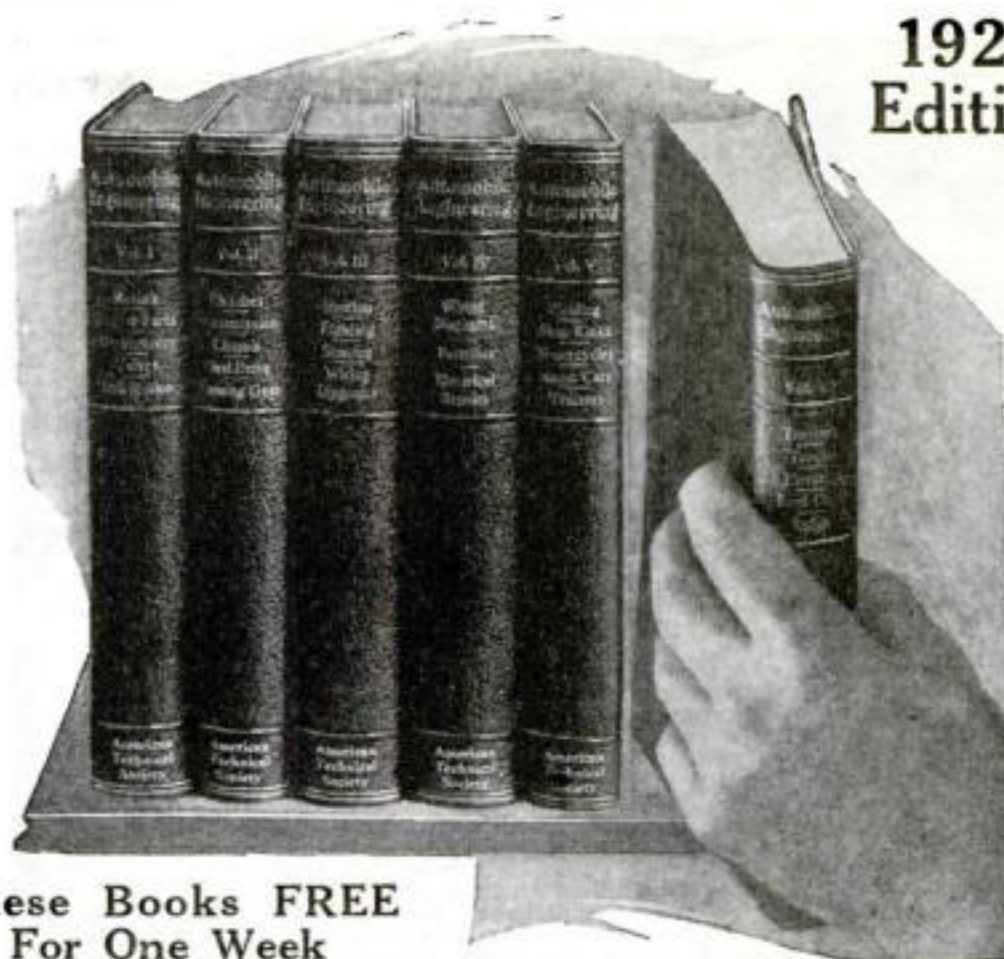
## Wire Ring Doubles Life of Tinware

UNTIL a month ago a shop in Pittsburgh wore out an average of three washbasins every two weeks. I finally recommended



that a piece of copper or soft iron wire be soft soldered to the bottoms of the basins. This was done and, judging from the condition after a month's trial, the basins ought to last for several years.—J. H. S.

1923  
Edition



## These Books FREE For One Week

Send no money—just fill out the coupon. After you receive the full set of books, express collect, read them over and test them out for seven days. If you don't want them, send them back at our expense. If you decide they will do for you what they have done for more than 100,000 others, pay \$2.80 within one week and \$3 each month thereafter until the special price of \$21.80 is paid. This amounts to only ten cents a day. Mail coupon NOW if you want a bigger, better job at higher wages.

## All Automobile Engineering Facts At Your Fingers' Tips

### Six Complete New Books for Study or Reference Also Year's Consulting Membership in American Technical Society—FREE

Here's the most practical set of books ever written on automobile engineering. Each book is brimful of information about the various phases of this work. 2,600 pages, 2,300 pictures and diagrams, 125 blue prints on every subject. Practical problems are solved in everyday language. They make automobile engineering as plain as day. Completely cross indexed for ready reference.

### Know All About Automobiles and Earn Big Pay

These are just the books for the man who wants to know all about automobiles and fit himself for a big-paying job. They are interesting from start to finish and crammed with information. A little regular reading in them during spare hours will soon equip you for the automobile business. Then after you get into the auto game, you'll still have them for reference.

### Let These Books Solve Your Daily Problems

To the man now engaged as a mechanic or shop foreman, these books will give a world of help. They dig deep into the technical angles and theories and explain them in everyday words. If you have trouble on any point, you'll find the answer in these books. They are the work of fifteen auto experts who know from experience, the problems and difficulties of the shopman.

### Repair Your Own Car

The car-owner will find these books extremely valuable as an aid in repairing his own car. Think of the heavy repair bills this will eliminate. Think of the money you can save.

## FREE Consulting Membership

A resident consulting staff of 18 practical experts is waiting to solve for you any auto, tractor or motorcycle troubles that you may have. A letter or a wire to the American Technical Society will bring you an immediate answer and the solution of your problems. This advisory staff of practical automobile men plus your library of Automobile Engineering will enable you to handle successfully any auto job. These men know all the latest methods and the newest and best ways of doing things. Let this pay-raising consulting staff be YOUR SILENT PARTNER. Use this service daily if necessary.

*This free consulting membership offer is good for a limited time only and can be withdrawn without notice.*

## AMERICAN TECHNICAL SOCIETY

Dept. A820

Chicago, U. S. A.

© A.T.S. 1923

American Technical Society, Dept. A820, Chicago, U. S. A.

Please send me a set of Automobile Engineering, for seven days' FREE EXAMINATION, shipping charges collect. I will examine these books thoroughly, and if satisfied, will send \$2.80 within seven days and \$3 a month until I have paid the special price of \$21.80. If I decide not to keep the books, I will return them within one week at your expense. It is understood that if I keep the books I am entitled to a FREE Consulting Membership in the Automotive Division of the Society.


Name.....

Address.....

Reference.....

(Please fill out all lines, give local merchant, banker or employer as reference.)





ESTAB. 1876

# W.L. DOUGLAS

**\$7.00 & \$8.00 SHOES ALSO MANY \$5 & \$6**  
**\$4.50 & \$5.00 SHOES FOR BOYS**

**WEAR W. L. DOUGLAS SHOES AND SAVE MONEY**


They are made of the best and finest leathers. The wide range of kinds, styles and prices provides suitable shoes for men and women in all walks of life. The quality is unsurpassed. The smart styles are leaders in the fashion centers of America. Whatever your ideal of a shoe may be, you will find it in the W. L. Douglas line of shoes.

Why pay high prices for your shoes? W. L. Douglas shoes are exceptionally good value. The quality, style and workmanship compare favorably with shoes selling at higher prices. If you had your shoes made to order, you couldn't get more perfect shoes. Frankly, is it not worth while in these days of high cost of living for you to save money on your footwear when the opportunity offers?


For thirty-seven years W. L. Douglas name and portrait have stood for a high standard of quality and dependable value. For economy and satisfactory service, wear shoes that bear this trade mark. We carry in our stores a complete stock of high class, stylish, up-to-date Men's, Women's and Boys' shoes. If not convenient to call at one of our stores, ask your local dealer for W. L. Douglas shoes. Look for the name and price stamped on the sole. If he cannot supply you, write for Illustrated Catalog showing how to order shoes by mail, postage free.

*W.L. Douglas* President W. L. Douglas Shoe Co.  
124 Spark St., Brockton, Mass.


Style No. 870  
Tan Norwegian Oxford




Style No. 1518  
Patent Coit One-Strap Pump  
Also in Black Satin Style No. 1519




Style No. 526  
Gun Metal Calf Bal.  
Also in Sunset Russia Calf Style No. 559




Style No. 1506  
Toney Red Oxford Cork Welt  
Also in Gun Metal Style No. 1505



Style No. 811  
Brown Kid Blucher  
Also in Black Kid Style No. 708



Style No. 613  
Black Kid Bal.



**TO MERCHANTS:** If no dealer in your town handles W. L. Douglas shoes, write today for exclusive rights to handle this quick-selling, quick turn-over line.

## This Wonderful Invention



converts any cook stove into a gas stove. Oxo-Gas made from kerosene and air is cheaper, cleaner and more efficient than coal. Send for catalog

illustrating Oxo-Gas appliances for all purposes where coal is used. We have openings for General Sales Managers and distributors. Only those who can finance themselves considered.

**GLORIA LIGHT COMPANY**  
108 N. MAY ST. CHICAGO, ILL.

## Deafness



Perfect hearing is now being restored in every condition of deafness or defective hearing from causes such as Catarrhal Deafness, Relaxed or Sunken Drums, Thickened Drums, Roaring and Hissing Sounds, Perforated, Wholly or Partially Destroyed Drums, Discharge from Ears, etc.

**Wilson Common-Sense Ear Drums**  
"Little Wireless Phones for the Ears" require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ears where they are invisible. Soft, safe and comfortable. Write today for our 168 page FREE book on DEAFNESS, giving you full particulars and testimonials.  
**WILSON EAR DRUM CO., Incorporated**  
210 Inter-Southern Bldg. Louisville, Ky.

## SMASHING SALE

By Oliver Typewriter Co.



**While They Last**  
**1000 No. 9**  
**Olivers**  
Rebuilt like new, right in Oliver Factory, only  
**\$44.50**

**\$200**  
**Down**

Never before an offer like this, and probably never again! Only the great Oliver Company itself could do it. Famous Model No. 9 Oliver at the slashed price of only \$44.50—and a year to pay! Genuine No. 9 Oliver with standard keyboard and all late improvements, rebuilt throughout like new right in our own factory. The equal—yes the superior, we say, of any \$100 typewriter on the market. And yours for only \$44.50 on this special sale of 1,000 machines.

### Free Trial—A Year to Pay

Act quick before the 1,000 machines are gone. Try, however before you buy. We give you 5 days free trial. Return or keep the Oliver as you decide. No cost to you whatever for the free trial. A year to pay if you buy. Write today for full particulars of this sale. Mail coupon or postal.

Oliver Typewriter Co.  
(Rebuilt Machine Dept.)  
Oliver Typewriter Bldg., Chicago

Oliver Typewriter Co.  
(Rebuilt Machine Dept.) 1108  
Oliver Typewriter Bldg., Chicago

Please send me full particulars of your sensational sale of 1,000 No. 9 Olivers.

Name.....  
Address.....

**Brings This**  
**Genuine**  
**DIAMOND**  
**RING**



Simply send \$2.00 for the Most Sensational Price Smashing Diamond Ring Offer Ever Made. A perfect cut, blue white, fiery Diamond in new hand pierced model of 18 Karat White Gold. Both sides of Diamond set with a Genuine French Blue Sapphire. Send Only \$2.00 and ring comes to you charges paid. Guarantee Bond accompanies each ring. 10 Days' Free Trial—You take no chance. If you are not satisfied at the end of ten days, your deposit will be refunded to you. No Red Tape, No Delay—After trial, pay \$5.55 a month for ten months. Price only \$57.50. Ring furnished in gentleman's mounting without extra charge. Free Book of Gems—Complete Diamond, Watch and Jewelry Catalog. 10 months to pay on everything from our TWO MILLION DOLLAR STOCK. Address Dept. 889, for your copy today.

**ROYAL DIAMOND & WATCH CO.**  
170 Broadway-New York

## How to Rebuild an Old Car

(Continued from page 78)

then necessary to press it off the shaft and replace it with a new one. Any end play in the transmission main and jack shafts is removed by inserting or removing shims, depending upon the construction. Where the main shaft joins the clutch shaft, a thrust ball is sometimes used and this may need replacing, as also may the bushing or bearing at this point.

The clutch should be carefully inspected, and doubtless will require relining. See that the clutch spring has good tension and that the thrust bearing in the throw-out collar is in good condition. Because of lubricating difficulties, this point is often worn and noisy. See that the clutch brake is in good condition.

When assembling or dismantling a clutch, the tension on the spring or springs causes the most trouble. By using a garage press, a vise, or even a jack, and blocking it, it is possible to compress the spring when dismantling or reassembling the clutch. When reassembling, see that all gaskets are renewed and proper provisions made for lubrication.

Universal joints require dismantling and the replacement of all worn parts. If they



Fig. 5. V-type motor inverted for scraping and fitting the bearings

are allowed to run with worn bushings they place undue strain on other parts.

Now comes the work in which the most pleasure is always found—overhauling the engine. The first essential is to have the exterior of the engine free from grease and dirt. Then start dismantling by pulling off all accessories. It is well to provide a separate box for each of the units, such as the starter, generator, carburetor, and distributor, and drop into the box all the screws belonging to each unit.

Next remove the head, if it is of the removable type, and turn the block upside down (Fig. 5) and remove the crankcase pan. Drain the oil before turning over. Next, inspect the rod and main bearing assemblies to see that they bear identification marks. The usual method of factory marking is 1-1 for the upper and lower halves of the first connecting rods, and these marks usually appear on the camshaft side. The second rod will be 2-2, and so on. If the rod and mains are not marked, prick punch them.

Now, pull all piston and rod assemblies. Lay them on the bench in order, maintaining the shims as you found them. Pull the main bearing caps. You may need to pull the timing gearcase cover before the front main can be removed, and may find also some transmission or clutch part at the rear to be removed.

With the timing gears exposed, the marks on them are located. These usually are prick punch marks at the edge of the gears, so arranged that the engine is properly

(Continued on page 109)



## How to Rebuild an Old Car

(Continued from page 108)

timed when they are brought together. If the gears are chain driven, arrow heads are at times used to indicate relative position.

Pull off the main bearing caps and lift out the crankshaft, so that the camshaft bearings can be inspected. The improve valves should be pulled previous to this operation.

With the engine entirely dismantled, the next step is an inspection of parts to see what must be replaced. In the case of the six-cylinder roadster shown in the first

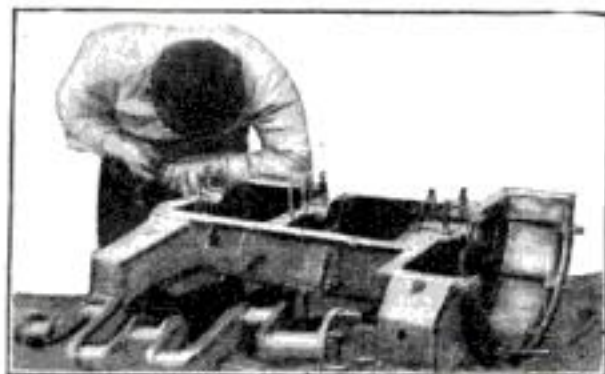


Fig. 6. Scrape the bearings until at least a 75 per cent bearing is obtained; then fit the caps

article of this series, the engine required 1 piston, 6 piston pins, 1 new valve, 12 rings, 1 main bearing cap, 1 oil line and 1 complete set of gaskets.

If the pistons can be made to show a rock on the pins, they should be renewed. Measure the piston clearance in the cylinders. If this is as much as .003 in. for every inch diameter of the piston, the pistons should be renewed. If the cylinder walls show light scores, use the old piston for a lapping tool and lap them out, as shown in Fig. 1, then fit the new piston with .001 in. clearance for each inch diameter. Piston clearance is measured with a thickness or feeler gage.

Mount the shaft on V-blocks and test for straightness. If sprung more than .002 in., it must be straightened in a straightening press or by means of a jack and chain.

Polish the shaft with emery cloth and if the journals show round within .001 in., the shaft may be fitted to the bearings (Fig. 5). First, take a light cut from the bearings in the crankcase. Next, treat with bearing blue and get an impression. Scrape until at least a 75 per cent bearing is secured, after which the caps are fitted, one at a time.

Each cap is fitted until it shows a good bearing and, when the cap nuts are all drawn down, it shows a slight yet positive drag on the shaft. Look out for false bearings and improperly fitted shims.

Rod bearings are scraped to a fit in much the same way. When getting the final impression, it is well to have the piston on the rod and assembled in the cylinder. An impression is secured by clamping the rod on the shaft and turning it with a bar. The high spots will show on the babbitt and as they are removed with the scraper, more and more surface is brought into contact with the shaft until a proper bearing is secured.

Each bearing will show a little drag and when all mains and rods are set up, the initial start of the engine will require a man on the crank, and another at the starter.

**NEXT month Mr. Kuns will continue his suggestions on reassembling the engine, overhauling the vacuum tank, the gasoline system, the generator and ignition system, painting the car, renovating the top, curtains and upholstery, and tuning up the machine for use.**  
—THE EDITOR.



**"I will now kill the first man who crosses that line"**

"Men," said the awkward old man who alone stood between the mob and their quarry—"I have tried to argue with you, and it's done no good. I don't know which one of you will kill me, but—I will now kill the first man who crosses that line."

How Old Judge Priest, disregarding his political future and only means of a livelihood, challenged an armed mob of lynchers single-handed—because he believed there had been "a case of mistaken identity on the part of the bloodhounds"—and what happened to him as a result of his interference—makes one of the best short stories to be found in the English language. It is just one of 88 great stories by

## IRVIN S. COBB

FOR THE FIRST TIME IN ONE UNIFORM EDITION

Now for the first time all of the best and most enduring of Irvin Cobb's stories have been collected into one uniform edition. Now for the first time you can get the best work of this writer whose stories the public loves so well that editors can conjure with his name!—a single story from whose pen adds hundreds of thousands to the sales of a magazine—who is now the most highly-paid short story writer in the world.

These are the Stories that made Cobb famous. There are 88 of them—the entire contents of 15 different books, now handsomely bound in ten large-size, uniform volumes. Separately, at bookstores, they would cost you \$22.50. By mailing the coupon while our introductory price is still in effect you get the entire set at one-third off regular price and on terms that make it ridiculously easy to own these wonderful books.

Cobb's humor alone would have made any writer famous, but the wide range of his genius carries you through the entire gamut of human emotions. Grotesque comedy, homely philosophy, baffling mystery and soul-searching pathos—you'll find them all in his stories. Out of the commonplace suddenly jumps the situation that brings a catch in your throat while your smiles struggle with your tears.

### These are the Books You Get:

Old Cap Collier  
Eating in 2 or 3  
Languages  
Sundry Accounts  
Local Color  
Back Home  
The Young Nuts  
of America  
Old Judge Priest  
From Place to  
Place  
Those Times and  
These  
Snake Doctor  
The Escape of  
Mr. Trimm  
One Third Off  
Speaking of  
Operations  
The Life of the  
Party  
Myself—To Date

## FREE 1,000 of the Best of the World's Good Stories

Just as an extra urge to you to act now instead of waiting, we are going to give to all of those who mail the coupon below, a two-volume set of "The Best of the World's Good Stories," compiled by Tom Masson, the famous editor of Life. They'll make you laugh. But they'll do more than that! Any man or woman who always has a good story ready to tell is sure of his audience whether he is delivering a political speech or selling life insurance. These two volumes will prove a real treasure trove of stories worth remembering. And, if you are among the first who order the collected edition of Cobb's works, these two extra volumes *don't cost you a cent!*

This is your chance. Send the coupon without money. Get all 12 volumes for a week's free examination. Send them back at our expense if they aren't the best stories you have ever read!

But tear off the attached coupon and mail it *today!*

Review of Reviews Co.,  
30 Irving Place, New York

Send me at your own expense the uniform edition of Cobb's collected works—to read, examine and enjoy for a week. I will either return them at the end of that time at your expense, or send you \$1 in 5 days and \$1 a month for 14 months. This is with the understanding that the two volumes of "The Best of the World's Good Stories," compiled by Tom Masson, are to be included free of charge.

NAME .....

ADDRESS .....

OCCUPATION .....





# Big Money in Music

A Conn instrument offers you a profitable career or a well-paying side-line, as you choose. Thousands are making big money with Conns; so can you. The demand for players of saxophone, trombone, cornet, trumpet, tuba—in fact all wind instruments—is increasing. Popular orchestras for dance, vaudeville, phonograph recording and similar engagements need players. Directors search constantly for new material.

Choosing a Conn instrument is your first step in winning recognition. For Conns are known everywhere as the "instruments of the artists." They are easier to blow; perfect in scale; most reliable in action; beautiful in tone. Let us explain to you fully their exclusive features. Conns cost no more than others.



Some Famous Conn Artists

Upper Left: John Philip Sousa, Director Sousa's Band. Right: Bohumir Kryl, Director Kryl's Band. Lower Left: Isham Jones, Director Jones Orchestra. Right: Paul Biese, Director Biese's Orchestra.

**FREE TRIAL: EASY PAYMENTS.** Send postcard for details. Highest honors at world expositions. Dealers and agents throughout the country. Factory branches in principal cities.

C. G. CONN, Ltd. 1132 Conn Bldg., Elkhart, Ind.

# CONN

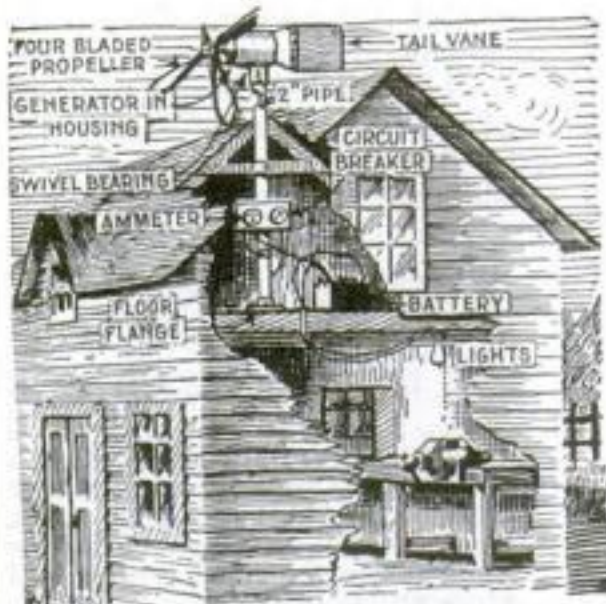
WORLD'S LARGEST MANUFACTURERS OF HIGH GRADE BAND AND ORCHESTRA INSTRUMENTS

## Lighting Your Shop with a Wind-Driven Electric Plant

By Robert S. Lewis

AT A surprisingly small cost for materials, any one handy with tools can construct a low voltage electric plant for lighting a shop, charging storage batteries, and similar purposes. This is accomplished by using standard automobile electric devices that can be purchased cheaply or salvaged from old or wrecked machines.

When selecting the generator, get one that has a third-brush arrangement for keeping the voltage uniform. This third brush, connected with one end of each field coil and also grounded, tends to decrease the efficiency of the field coils as the speed increases, and therefore makes the output more or less uniform for all speeds. It is, therefore, unnecessary to use clutches and



Mounted above the roof, a wind-driven automobile generator provides current for the workshop lights

governors to compensate for the variable speed of the air propeller or vaned wheel.

Either an old battery, if in fair condition, or a new one can be used, and an ammeter and circuit breaker also are required. The ammeter enables one to tell whether the generator is working at the best output for charging the battery, and the circuit breaker cuts the battery in and out as required. Without the latter, there would be a leak back from the battery when the wheel and generator are standing still or rotating slowly.

To simplify the construction, all gears and shafting are done away with. The generator is mounted on a flanged base, into which is screwed a short section of 2½-in. iron pipe. A two- or four-bladed propeller or a small wheel built on the familiar lines of an ordinary windmill wheel is carried on the extension of the armature shaft, to which it is attached by means of a pinned flange. Since the generators are equipped with ball bearings, the thrust of the propeller is taken care of automatically. The bearings are lubricated by packing them occasionally with a good grade of light grease.

The outfit is mounted on a standard of 2-in. iron pipes arranged to suit individual requirements. The ideal installation, as shown, is on the roof-top of a two-story shop or outbuilding. Standards can be stiffened against the beams, as required.

The short length of 2½-in. pipe attached to the generator pivots freely on the standard. The superfluous play is taken up by a double row of setscrews through the larger pipe. These are locked with nuts, as shown.

(Continued on page 111)



## Learn Electricity

How would you like to earn two or three dollars every evening after school and prepare yourself for a fine big job at the same time? Here's the opportunity of a lifetime for you fellows who like Electricity. Begin right now to prepare yourself for a regular man's size job in this fascinating field. Your chances for a big success are simply wonderful—the pay is big (\$70 to \$200 a week) and advancement comes swift and sure.

### Look What This Boy Is Doing

"Although the School term is coming to a close and I am pretty busy with my examination, I manage to keep up with my electrical studies and work."

"I guess I forgot to tell you I am now in business for myself. Am doing fine, but owe it all to you. If it had not been for your Course, I, being under age, could not have secured my license in this town. But I got it, and now have all the work I can do, averaging \$20 to \$30 a week thru spare time work."

"I went out on a job tonight after school, on which I made \$3 and brought home another on which I made \$2.50—\$5.50 for 4 hours' work and no material furnished by me."

ROGER SMITH,  
1215 Chestnut St.,  
Greenville, N. C.

### I Will Train You at Home

With my easily learned, spare time Electrical Course I will train you at home like I have trained hundreds of other boys who are now big successful men. It will not interfere with your school work and you can earn more than the small cost of the course doing odd electrical jobs in your spare time. The Course pays for itself. I will show you how to get this work and how to do it. Some of my boy students make \$10 to \$15 a week this way.

### Tools, Apparatus and Radio Course FREE

Send me the coupon below and I will tell you all about the big outfit of tools, apparatus and instruments and a new Radio Course that I am giving to my students for a limited time. I will send you my big interesting Electrical Book and a sample lesson too—all Free. You will be tickled with the things I will send you Free. Mail the coupon right now.

L. L. COOKE, Chief Engineer  
Chicago Engineering Works  
Dept. A-38 CHICAGO

### Use This Free Outfit Coupon

L. L. COOKE, Chief Engineer,  
Chicago Engineering Works,  
Dept. A-38  
2150 Lawrence Ave., Chicago

Send me your Free Outfit Offer, your big Electrical Book, Sample Lesson and particulars of your Electrical Course and Free Radio Course. This will not obligate me in any way.

Name.....

Address.....

For use of boys 15 years old or more.

## Home Protection

with an  
**ASTRA**  
Automatic  
will cost little



Nearly every man wants a gun in the house—he feels better able to protect his family. We are able to offer these Genuine Astra guns at special prices because we bought before recent tariff raises became effective. Really fine guns, beautifully finished, hard hitting. Use standard ammunition. Order direct from U. S. Importers.

\$7.75 25 calibre—7 shot—C. O. Q. Automatic.  
8.95 25 calibre—7 shot—Astra Automatic.  
9.95 25 calibre Astra with triple safety.  
10.95 32 calibre—10 shot Astra, extra magazine.  
16.95 32-20 and 38 cal. swing-out cyl. revolvers.

We guarantee every gun against defective workmanship; brand new; of Drop Forged Steel Through-out. Before buying any weapon INSIST on this guarantee. SEND NO MONEY unless you wish. State model desired—pay postman on delivery plus postage. Satisfaction guaranteed or money refunded. Write for new firearms catalogue.

CALIFORNIA TRADING CO.

Dept. 111, Terminal Bldg., Los Angeles, Cal.

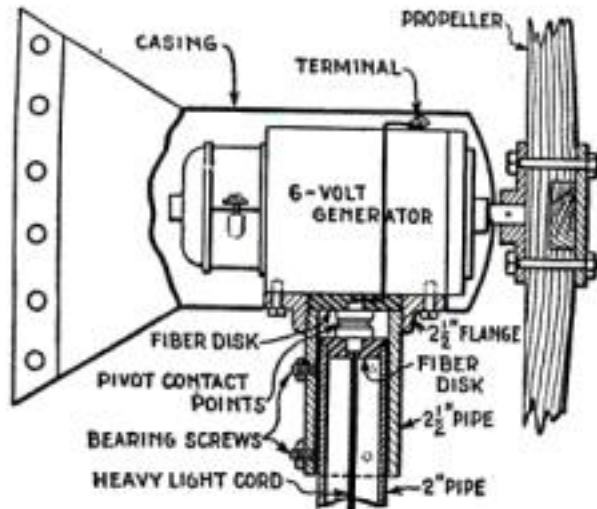


## Lighting Your Shop

(Continued from page 110)

The weight is carried on two brass thrust pivots, each mounted in its own fiber disk. The upper pivot point is connected with the positive terminal of the generator by a wire passing through a groove chipped in the generator flange. The lower pivot connects with a wire leading down through the center of the pipe standard and passing out at the bottom through a hole bushed with a porcelain insulator.

The weight of the mill keeps it down on the pivot contact points at all times. The



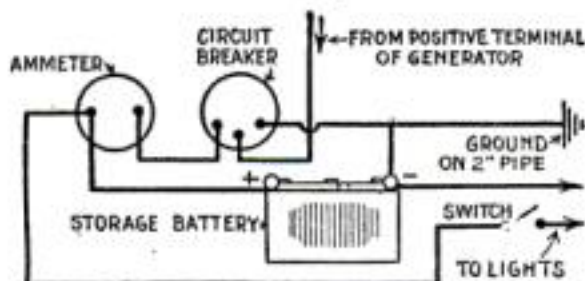
How the automobile generator is mounted on a pipe standard and provided with wind wheel and vane

setscrews make a sure contact for the grounding of the generator.

A weatherproof hood is made from a section of galvanized pipe, and the rear end is bent, as shown, so that the vane can be bolted to it. The semicircular front head of the casing is bolted or slipped tightly over the front of the hood, so that the interior will be water- and dust-tight.

In mounting the generator on its flange, take care that the screw holes do not enter too deeply.

My experience has been that the 24-in. four-bladed propeller—the blades about  $3\frac{1}{2}$  in. wide—provides ample power to drive the generator when the prevailing winds are fairly high and steady; if high winds prevail, a two-bladed propeller will suffice. The ordinary type of windmill wheel, built on a small scale, is much more efficient, however, if the winds are not strong and reliable. The builder should use his judgment as to which will best serve his purpose. The four-bladed propeller shown is made of two pieces of spruce, with a cross lap joint at the center. A good waterproof glue should be used in joining them and the finish should be spar varnish. The

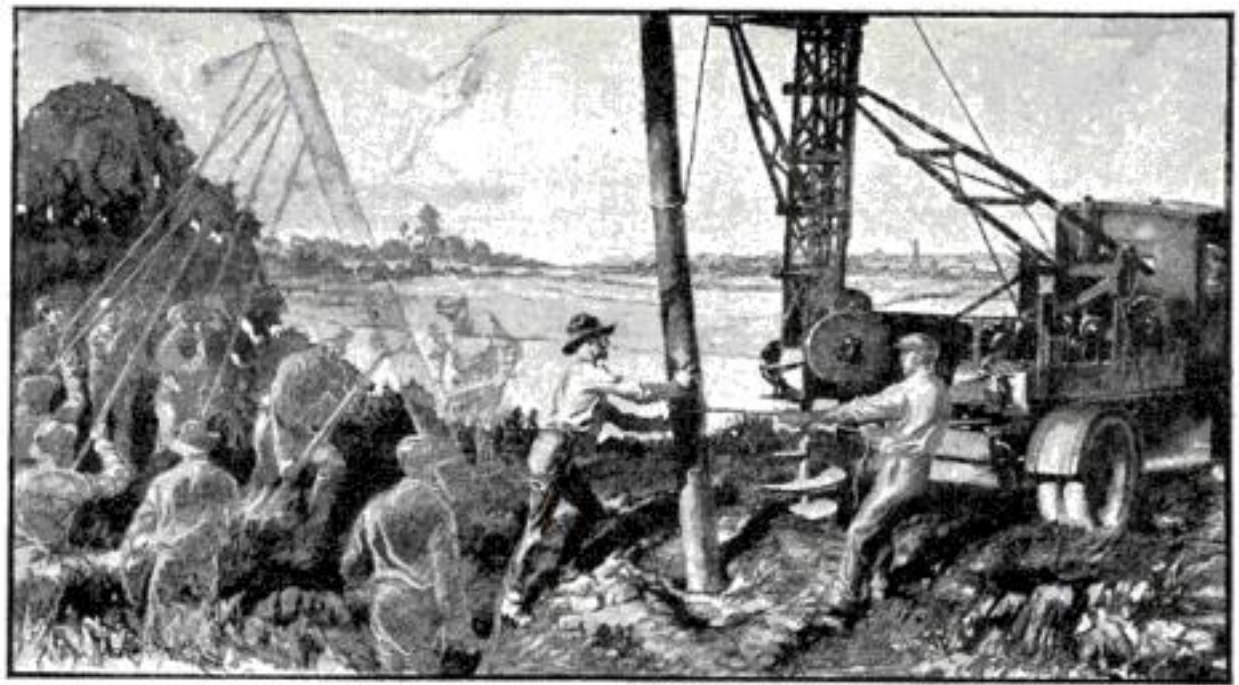


The electrical units are hooked up as in an automobile

propeller is bolted to the hub with  $4\frac{1}{4}$ -in. screws, and a steel plate or washer is clamped on the front surface of the propeller hub to prevent splitting.

The instrument board should be mounted near the battery, with the instruments arranged as shown. The wiring diagram above gives the hook-up.

(Turn to page 112)



## Multiplying Man-power

To the man with pick and shovel the digging of holes for telephone poles is a slow and arduous task. Under favorable soil conditions three to five holes are for him an average day's work. Under adverse conditions perhaps he can account for only one. When the hole is dug, eight or ten men are required to raise the pole with pikes.

But the hole-borer with derrick attached, operated by only three men, can erect as many as eighty poles in a day—releasing for other telephone work upwards of forty men.

Hundreds of devices to quicken telephone construction, to increase its safety to the employee, and to effect economies are being utilized in the Bell System. Experiments are constantly being made to find the better and shorter way to do a given job. Each tool invented for the industry must be developed to perfection.

In the aggregate these devices to multiply man-power mean an enormous yearly saving of time, labor and money throughout the whole Bell System. Without them telephone service would be rendered neither as promptly, as efficiently nor as economically as it is to-day.



### "BELL SYSTEM"

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
AND ASSOCIATED COMPANIES

One Policy, One System, Universal Service, and all directed toward Better Service

### MASTER ELECTRICITY AT HOME

A practical man will lead you to success. Write only if you are in earnest. Our FREE book plainly tells how Burgess Home Training enables men and boys to get good jobs and hold them. Write for your copy TODAY. Romance of real success on every page.

**FREE**  
**PRACTICAL COURSE EASILY APPLIED**  
No Mystery; no bunk. Just honest, helpful instruction, which anyone can understand and follow. All branches of electricity covered. We help you to a position, during and after instruction. 30 lessons in Slide Rule, FREE to each student. WRITE FOR FULLY ILLUSTRATED BOOK TODAY.  
New Radio Course Now Ready.  
BURGESS ELECTRICAL SCHOOL  
Dept. 11, 746 East 42nd St., CHICAGO  
Canadian Branch: 201-C Crawford St., Toronto

### Free Book-LAW

Send for this Free 118 Page Book. It tells how you can gain a thorough knowledge of law in your spare time, as 40,000 others are doing. Splendid opportunities in the profession of law. Business today needs law trained men. Free book gives experiences of successful law trained men, and tells how you can read law under guidance of Ex-President Taft and 80 other eminent authorities.  
**Blackstone Institute**  
Dept. 151 4758 Grand Blvd. Chicago



### Ukulele Free!

Genuine Koa Wood finish Hawaiian Ukulele. Sweetringing tone. Given free with Short-Cut Ukulele Instruction Course. Teaches you to play in one hour! No popular! Play latest hits.  
Clip this Ad  
**Learn to Play by In One Hour!** our amazing new copyright course. No months of practice—just one hour.  
**Send No Money** for course and FREE Ukulele outfit. On arrival deposit with postman only \$2.98 plus a few pennies postage. We guarantee complete satisfaction or money refunded. Send now.  
**FERRY & CO, 75 W. Van Buren, Dept. 1782 Chicago, Ill.**



*Learn to Play*  
**Begin Today—Write for My FREE BOOK**  
I can make a good penman of you at home during spare time. Write for my FREE BOOK, "HOW TO BECOME A GOOD PENMAN." It contains specimens and tells how others mastered penmanship by the Tamblin System. Your name will be elegantly written on a card if you enclose stamp to pay postage. FREE BOOK—Write for it Today.  
**F. W. Tamblin, 437 Ridge Bldg., Kansas City, U. S. A.**



# New High Paid Profession of Scientific Barber

## Moler System Graduates Earn Big Money

### Learn Near Home at Moler College

You have right close to you a fine equipped and directed Moler-College. Pick out nearest one and write or stop in.

157 Third Ave.	New York, N. Y.
105 S. Wells St.	Chicago, Ill.
810 N. 6th St.	St. Louis, Mo.
544 Main St.	Kansas City, Mo.
206 E. 4th St.	Cincinnati, Ohio
215 Huron Rd.	Cleveland, Ohio
1045 Cass Ave.	Detroit, Mich.
1229 17th St.	Denver, Colo.
110 S. 14th St.	Omaha, Neb.
513 E. Water St.	Milwaukee, Wis.
1005 Canal St.	New Orleans, La.
23 N. Forsyth St.	Atlanta, Ga.
80 N. 2nd St.	Memphis, Tenn.
910 Main St.	Dallas, Texas
712 Franklin Ave.	Houston, Texas
727 W. Commerce St.	San Antonio, Texas
198 Queen St., E.	Toronto, Ont., Can.

Mail Coupon for full information on this high paid profession with Free Booklet C.

Many Moler System graduates own their own fine businesses and earn from Five to Ten thousand dollars a year. Modern, scientific barbering as taught by the Moler System gives you a profession that enables you to earn from Fifty to One Hundred Dollars a week within a few months of the time you start to learn.

**Be Your Own Boss.** You can own your shop and be independent with a very good income. We will equip your place for you on easy terms.

**The Moler System** has shown thousands of men a sure, easy to learn way to make good money in a clean, carefree business.

**Hotels, Office Buildings** and individual shops call for well dressed, well paid men to run them. The Moler System teaches you the latest scientific

methods including the electric hair-cutter, mechanical massage, scientific treatments and girls' hair bobbing. There are special courses also on scalp and skin treatments.

**Learn About This New high paid business.** We will tell you how to earn while you learn and show you how to get the best city jobs or equip your own shop. Call or write today for our free booklet C at branch nearest you as listed here. Use the coupon below.

### Moler System of Colleges

..... (Write Nearest Branch)  
Please send without obligation your Free Booklet C and full information.

Name .....

Address .....

### Special to Moler Post Graduates

Our Post Graduates may become part of our System after completing, use our name, and benefit by our National Advertising educating the public to Moler Post Graduate Service.

### Moler System of Colleges

33 Branches

Address nearest in above list

## \$25.00 in PRIZES

SEE TOP OF PAGE 6 IN FRONT OF BOOK FOR DETAILS

### WRITE JOKES

EARN FROM \$50 TO \$150 PER WEEK

writing jokes, epigrams and humorous stories for publications. Tremendous demand for material. Our short course in Humor Writing teaches you to write humorous material that sells. Learn in your spare time—earn in your spare time. Complete marketing plan and markets furnished.

Write for full particulars

**AMERICAN INSTITUTE OF HUMOR**  
Office K, 414 Park Bldg., Cleveland, Ohio



### DO YOU LIKE TO DRAW?

CARTOONISTS TRAINED BY W. L. EVANS

## MAKE MONEY

Some of the cleverest cartoonists are former students. They had no experience before enrolling, but worked at the lessons during their spare time and found **CARTOONIST EVANS' METHOD "easy to learn"** and are now making good money. It is not hard to learn to draw originals when shown in a practical way.

The School is recommended by well known cartoonists because they know the students are handled right.

If you like to draw and want to be able to sell your drawings, send a sample of your work (either a copy or an original) and let us see what you can do. We will send you the portfolio of cartoons and full details about the school.

The Course is NOT EXPENSIVE



**THE W. L. EVANS SCHOOL OF CARTOONING**

825 Leader Bldg., CLEVELAND, OHIO

**King TUT**  
**GOOD LUCK RING**  
**\$1.95**  
Don't Send a Penny!  
Famous Movie Stars wear King TUT'S GOOD LUCK ring. They say it brings success, happiness, love. Over one million sold. Only original LUCKY ring, beware of imitations. Genuine silver finish.  
Order: Was \$5, now only Today! \$1.95, c.o.d. post-age paid. Cash with order \$1.75. 2 for \$3.25. Be sure to send paper strip for larger size. Stated if men's, women's, boy's or girl's size.  
GOLD WATCH CO. Dept. 709, 3501 S. Michigan Ave., CHICAGO

### Make Money Taking PICTURES

Tremendous big-paying opportunities are open for ambitious men in Modern Photography. This is the picture age. Magazine and newspaper publishers buy thousands of photographs each year. Every manufacturer sends out high priced pictures of his products. Every home wants portraits. Photography is a business running into millions of dollars each year. And there is a great shortage of trained photographers.

#### Got \$100 for Flood Pictures

"I took pictures of a flood and sold them for \$100. I have been able to buy my house and lot from the sale of pictures."  
C. M. Cole, Washington.

#### \$97 in Two Days!

"I made \$97 in December. Went out two days last week on home portrait work, and made \$97."  
A. G. Hughes, Kentucky.

#### EARN \$3,000 to \$10,000 a Year

Hundreds of men are earning big money and establishing their own businesses. Even during spare time, while training, you can make \$75 a week easily—no matter where you live!

#### Amazing New Easy Method

I show you, at home, how to do the kind of work turned out by the big studios in New York and Chicago! I show you how to make big money within 30 days! C. M. Cole bought a home with money he had made when only half way through his training. So well do I know what I can do for you that I guarantee under bond to return every cent of your tuition if you are not thoroughly satisfied.

#### Professional View Camera FREE!

Write at once for Free Camera Offer—I give you, free, a splendid professional view camera. You will be astonished and delighted. This offer open for short time only—so act quick. No obligation.

**INTERNATIONAL STUDIOS, Inc.**  
Dept. 2388  
3601 Michigan Ave., Chicago, U. S. A.

### Lighting Your Shop

(Continued from page 111)

The outgoing current is led down through the pivots and into the long wire in the pipe. From there, it enters the center binding post of the circuit breaker. A tap is then led out of the left-hand binding post to the ammeter. Two leads go from the ammeter, one to the positive terminal of the storage battery, and the other directly to the lighting circuit. The negative terminal of the battery is then connected with the other leg of the lighting circuit.

A tap is also run from the right-hand binding post on the circuit to a ground, so that when the generator is charging, but not heavily enough for the battery, a circuit is made for short circuiting the current; otherwise the generator wiring will be endangered.

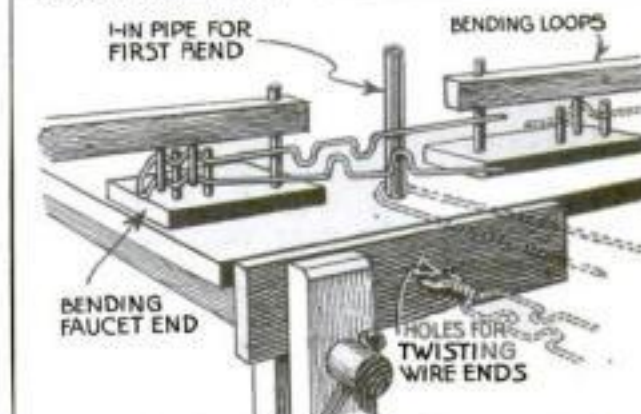
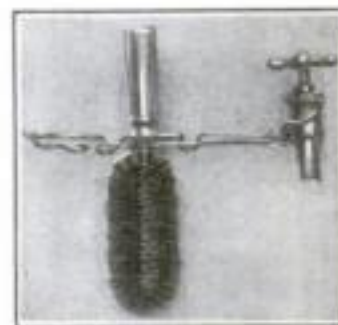
The arrangement is practically the same as that of an automobile, and any one with a slight knowledge of mechanics can build and operate the set to perfect satisfaction. The specific gravity of the battery should be tested weekly to find out whether it is being fully charged. Add distilled water as required and keep the hydrometer and water bottle handy.

Wire the shop for low voltage sockets and bulbs wherever needed. Care should be taken not to waste the current by leaving the lights turned on when not actually required.

### Brush Hangers Cheaply Made in Ingenious Bench Fixture

AFTER a six months' siege of typhoid fever, I recently found myself without work and in urgent need of money to meet household expenses. In this emergency I turned to my home workshop and made a number of sink brush hangers, as illustrated, in a simple bench fixture.

The hangers, made of No. 11 galvanized iron wire, are slipped over the sink faucets and hold



The brush hangers in use (above) and the bending fixture for making them (below)

dishcloths and brushes. These I sold from house to house, earning enough to support my family for more than four months.

One of these brush holders can be made quite quickly with pliers, but to turn them out in quantities, I used the homemade press shown.—J. L., New Britain, Conn.

It is advisable never to put a brush away, even overnight, full of paint. A brush should always be cleaned of all surplus paint after use or its chisel edge will be damaged.



**YOU  
can boss  
this job**

*Put yourself  
in this man's place*

**Earn \$75 to \$200 a week  
as an Electrical Expert**

**YOU** can do it. Electricity is the biggest, fastest growing industry in the world today. Hundreds of millions of dollars being spent in development yearly! Millions of dollars to be paid for *trained brains*. A big, high-pay job waiting for you just the minute you are ready. Earnings of \$15 to \$35 and up per day by trained electrical experts are common.

### Independence and Success for You in Electricity

Don't plod along on low pay, futureless work when the magical field of Electricity beckons you. We will train you quickly at home for big-pay electrical construction and service jobs and guarantee your success.

Thousands of men starting Electrical Contracting, Electrical Specialty, Radio or Automotive Electrical businesses "on a shoestring" are becoming wealthy. You can do it, too! We will help you do it. Resolve now to get in on the ground floor in the beginning of the great Electrical Age.

### Send for Our Big 64-page Illustrated Book on Electricity

Learn all about the Associated Electrical Engineers—the most remarkable Electrical Training Organization on earth. Not a mere school, but a great National Organization of real Electrical Experts and Specialists. As a member of the Associated Electrical Engineers you will get the finest, most complete and easily mastered electrical training on earth right at home, in your spare time. And in addition we help you to "cash in." We show you how to make big money on the side while learning; how and where to find and hold the big money electrical jobs; how to establish your own electrical business without capital. We stand squarely behind you until you have made a BIG SUCCESS.

### You Have Education Enough

You do not need a high school or college education to make a big success in Electricity by our EXCLUSIVE and COPYRIGHTED method. We start you right "off the ground" and build you up into the big-money class of Electrical Experts.

### A Wonderful Experimental Outfit FREE

You start at once on practical work with our big FREE working outfit of electrical appliances, so you are not delayed in getting into actual money-getting work. A. E. E. Training includes complete courses in RADIO and AUTOMOBILE ELECTRICITY—the best to be had anywhere—given

## Associated Electrical Engineers

Dept. B-1

537 S. Dearborn Street, Chicago

**\$25 in Prizes**

See top of page six in front of book for details

## Stop Using a Truss



Reduced  
Fac-Simile  
Gold Medal

STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemical applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the public bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. Soft as velvet—easy to apply—Inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

Plapao Co., 790 Stuart Bldg., St. Louis, Mo.

Name .....  
Address .....  
Return mail will bring Free Trial Plapao.



Reduced  
Fac-Simile  
Gold Medal

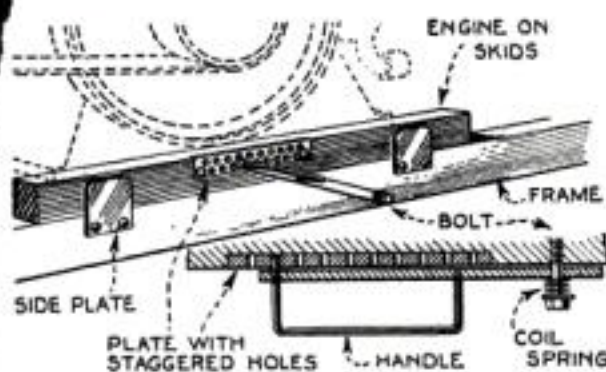
STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemical applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the public bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. Soft as velvet—easy to apply—Inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

Plapao Co., 790 Stuart Bldg., St. Louis, Mo.

Name .....  
Address .....  
Return mail will bring Free Trial Plapao.

### ing a Simple Belt Tightener for Portable Machines

WHEN small gasoline engines on hand skids are used to operate portable machines and other machinery mounted on the frame, and the skids slide between the plates on the frame, it usually is difficult to keep the belt tight and make the necessary belt adjustments. How one man



How the tightener is used and a sectional view showing the details of its construction

solved this problem is shown in the accompanying illustration.

The main member of the belt tightener is a length of flat stock with a hand grip, made as shown, so that one end projects like a pin on the other side of the bar for an inch or two. A plate bearing two rows of staggered holes is sunk flush in the upper edge of the engine skids. The belt is tightened by sliding the skids along the frame, and the lug of the tightener is dropped into a center hole and the tightener fastened with a lag screw to the frame. Under the head of the lag screw is placed a washer and a spring to keep the lug properly seated. A considerable range of adjustment is then possible by placing the tightener lug in the various holes.—L. S.

### How to Wash Your Auto

TO WASH an automobile properly, begin with the wheels and under side of the fenders, using a gentle stream of water that does not carry more than 6 in. from the end of the hose. Wash off any oil spots with a sponge and soapy water, but rinse immediately.

The chassis completed, flow off all the dust on the body, and then wash the body with a wet sponge. Squeeze the sponge dry, remove all superfluous water, and dry the body with a chamois skin.

Finally, wash the hood and radiator top, drying them with the chamois skin.—C.L.A.

### Backed by a Legal Guarantee of Satisfaction

under the direction of SPECIALISTS, who show you how to make big money in these limitless fields. You get back every penny of the small membership fee you pay if you are not thoroughly satisfied when you finish your training. We both must make good before it is a deal.

### Mail the Coupon NOW

No matter what you are thinking of doing to increase your earning power and insure your success, YOU OWE IT TO YOURSELF to investigate the great Electrical Field and the WONDERFUL MESSAGE WE HAVE FOR YOU. Our big illustrated 64-page book on Electricity is FREE! Send for it NOW.

### Opportunity's wide-open door

### Send for our 64-page book today

ASSOCIATED  
ELECTRICAL ENGINEERS  
Dept. B-1

537 South Dearborn Street  
Chicago, Illinois

Without any obligation, please send me FREE, your 64-page book on Electricity and full details of how I can make big money as a member of the Associated Electrical Engineers.

Name .....

Address .....

### LEARN AUTOS and TRACTORS

Wonderful opportunities constantly offered trained men—We train you thoroughly to start your own business, or to make good money as motor expert, driver, shop foreman, etc., and furnish you with a \$12.00 tool kit free of charge. This is the pioneer auto school.

Over 7000 graduates making good.

Catalog free.

Cleveland Automobile School, 1821 East 24th Street, Cleveland, Ohio

**FREE  
VACUUM TUBE  
RADIO SET**

Can receive 100 miles and more.

**RUSH** your name to learn how you can get a Vacuum Tube Radio Set.

**ABSOLUTELY FREE** Don't delay; write today for FREE RADIO PLAN.

**HOME SUPPLY CO.**  
Dept. 12  
131 Duane St., N.Y.C.



# Have You Been Introduced To These New Words?

Thousands of NEW words have come into the language. Are you making them a part of your vocabulary? Can you spell, pronounce, and define them? The "Supreme Authority"—

## WEBSTER'S NEW INTERNATIONAL DICTIONARY contains the facts you wish to know.

407,000 Words

6000 Ills.  
2700 Pages

Growth in all activities of modern life may be traced by the New words in WEBSTER'S NEW INTERNATIONAL

Here are samples:

marquiesette	Schick test
camp-fire girl	rotogravure
mystery ship	mirrorscope
Air Council	radiophone
aerial cascade	capital ship
junior college	Blue Cross
Czecho-Slovak	royal spade
Devil Dog	Waac broadcast
overhead	realtor photostat
Flag Day	bloc nose dive
agrimotor	soviet stop back
irredenta	nacelle narcism
Esthonia	B. L. E. altigraph
vitamin	zircite Riksdag
paravane	askari Red Star
psoriasis	cyper S. P. boat

and thousands of others

Write for a sample page of the New Words, specimen of Regular and India Papers, also Booklet "You are the Jury," prices, etc. To those naming this magazine we will send free a set of Pocket Maps.

G. & C. MERRIAM COMPANY  
Springfield  
Mass.



G. & C. MERRIAM COMPANY, Springfield, Mass. GENTLEMEN: Send sample page of New Words, specimen of Regular and India Papers, Free Maps, per Pop. Science Mo.

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_

## "The Rower" Is a Unique Mechanical Cigar-Box Toy

By Capt. E. A. McCann

TURN the handle of this toy—the man rows and the waves heave with surprising realism. Although the lifelike action seems complicated and somewhat puzzling, the toy is really simple, and any one who is handy can make it without special tools or any expense worth mentioning.

You will need two cigar boxes, each 2 1/2 in. deep. Take the bottom off one, and in the lid cut three or four slots, as indicated in Fig. 2, almost the full length of the box.

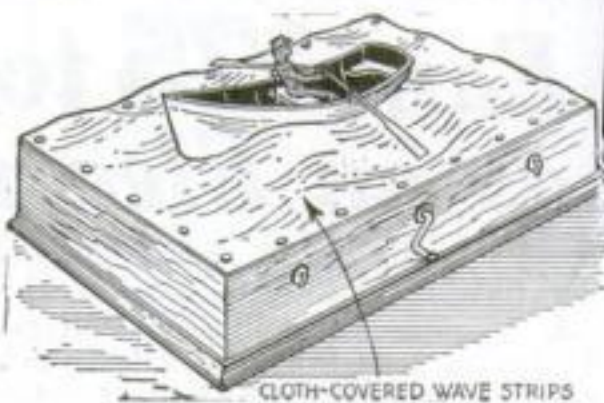


Fig. 1. When the crank is turned, the man rows and the waves move up and down and roll forward realistically

and wide enough to allow a slip of wood cut from the lid or sides of the other box to be inserted in them. The slip should work up and down easily.

Cut three slips altogether and shape them as shown in Fig. 3, the top edges representing wave crests. Two holes are drilled in each to take the cranks, and the center curve at the bottom is made to clear the middle crank. The slips must be shorter than the slots by the length of the throw of the cranks.

Next, make the shafts from fairly heavy stiff wire; they should be shaped as shown in Fig. 2. The center one has a small crank in the middle and another at one side to move the other cranks through the connecting rod.

The connecting rod is a piece of metal. A strip of tin from a can will do if it is doubled over to make it quite stiff. The holes for the three cranks must be drilled accurately after they are in position. The center crank does not connect at all with the waves and, of course, the handle can bend up at either end, or handles can be placed at both ends, if desired.

Each of the two end shafts is bent so that the cranks connecting with the wave slips are at right angles to the crank for the

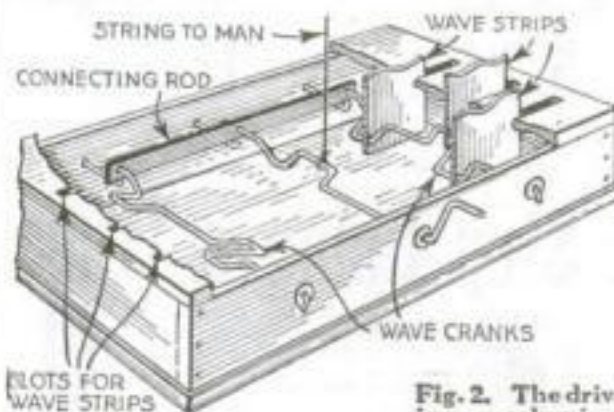


Fig. 2. The driving mechanism

connecting rod. The cranks are arranged so that when one end of a wave is up, the other will be down.

Slip these shafts through the holes in the waves, place the waves in their slots, and then bore holes accurately in the sides of the box for the shaft bearings. Ease out

(Continued on page 119)

need for anyone to be a wall flower. Murray, America's foremost authority has perfected a method by which you can learn to go to a dancing class—no private lessons—you don't need to get them to teach you. Through Murray's new method, more than 90,000 persons have learned this way and there is no reason why you should not do as well.

The five free lessons are How To Gain Confidence, The Secret of Learning A Lesson in Fox Trot, the Current Dancing Position, and How to Follow. These lessons are sent free, but to pay for mailing and wrapping just enclose 25 cents. Learn in private—surprise your friends—write today for the FREE LESSONS.

ARTHUR MURRAY, Studio 872, 250 Broadway, New York City

## PROTECT YOUR HOME AND FAMILY



with this  
25 Cal.  
Automatic  
Pistol  
\$8.75

These  
Pistols  
Take Any  
Standard  
Ammunition

Every LAW-ABIDING Citizen should be armed and prepared to meet the burglar, thief and hold-up man! You will be fully protected with this brand new 25-Cal. regulation Blue Steel "Spanish Bronco." Fires 7 shots in 3 seconds; accurate and powerful; guaranteed not to jam or misfire; double safety lock prevents accidental firing; model, extra light weight; perfect aim; get one now at this bargain price while they last. . . . \$8.75

### OTHER SPECIALLY REDUCED BARGAINS

32 Cal. 20-shot, Military Model, with extra Magazine FREE.	\$10.25
25 Cal. 6-shot Blue Steel	\$6.25
25 Cal. 8-shot Mauser	\$11.95
32 Cal. 7-shot Mauser	\$12.95
30 Cal. 9-shot Luger	\$14.25

32 or 38 Cal. HAND EJECTOR	\$17.25
32 or 38 Cal. Break-Open REVOLVER	\$8.25

Brand New Guns Use Standard Ammunition. Satisfaction Guaranteed or Money Back. Pay Postman Our Price, Plus Postage. EDWARDS IMPORT TRADING CORP. 258 Broadway Dept. 36-11 New York

## 20¢ A DAY PAYS for a Piano

Before you buy a Player-Piano or Piano, get our beautifully illustrated FREE Book showing popular models of famous sweet-toned Symphonies. Easy payments. Save \$100 or more. 25-year Guarantee. Write TODAY. Larkins Co. Inc. Dept. P-1148 BUFFALO, N. Y. Peoria, Ill. Chicago, Ill.



## "The Rower" Is Unique Toy

(Continued from page 118)

one side of the box and get them in. The ends of the cranks may be clinched over washers to steady them.

From a piece of soft wood cut a small flat-bottomed boat about 3 in. long; hollow it out and make it as neat and complete as you wish. If you prefer, build it from bent cigar-box wood. Also make a small figure of a man, either flat (out of cigar-box wood) or carved (from a stick). Glue or screw him on the seat to fit the middle of the boat and fasten this in position by means of a pin through the gunwale on either side so that the seat will swivel easily. The figure should be sitting upright or bent a trifle forward, with his heels on the bottom of the boat.

Make a pair of oars and fasten them to the figure's hands with wire rings. Put staples in the gunwales to represent oarlocks and see that the oars work easily.

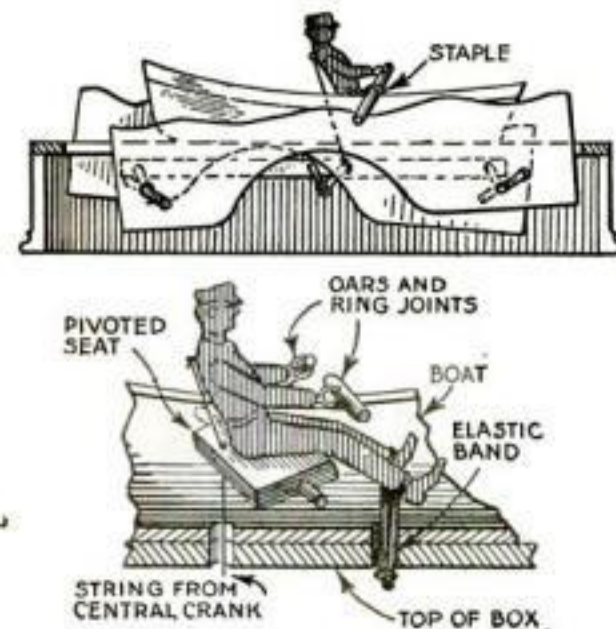


Fig. 3. Details show how the wave slips are shaped and the rower's figure is mounted

Also bore two holes through the bottom of the boat and top of the box (Fig. 3).

Pass an elastic band over the toes or around the ankles of the figure and fasten it to a staple inside the box. As far back as possible, fasten a light string—fishing line for preference—to the shoulder of the figure, pass it through a hole in the seat and down into the box. Connect it with the center crank with a wire loop, for which it is advisable to file a small groove in the crank. This groove will prevent the loop from slipping from the center. The string should be of such a length that when the crank is down, the man leans well back. If your crank should be too long, leave the string slack; if too short, make a new crank.

On turning the handle, all three shafts revolve. The cranks of the end shafts cause the waves to move up and down with a forward movement. The center crank causes the man to move backward and the elastic pulls him forward again.

Paint the toy to suit your taste, and it is then complete in its essentials. An evening's work is sufficient to make the whole thing. While a fretsaw is handy, a sharp pocketknife will do the cutting, and a square-nosed pliers will aid in making the cranks. These are best hammered to right angles against a sharp piece of iron.

You may add many refinements such as modeling the man artistically and passing the string up through his body instead of back of him. If you cover the box with light blue cotton cloth over the waves and under the boat (Fig. 1) and glue it or tack it to the sides of the box and to the wave tops, leaving it slack, the waves appear very real.

## Stylish Moleskin

# \$1 Cloth Coat

## DOWN

Send only \$1 with coupon for this coat. Guaranteed rain proof and is also suitable for stylish top coat. Made from good weight moleskin cloth, a smooth, soft-finished material resembling chamois leather. Warm and comfortable in the coldest weather. Swagger double-breasted belted style with stylish plaited patch pockets. Adjustable strap on sleeve. Yoke back with inverted plait, giving the coat plenty of fullness. Collar can be converted into military style, buttoning close up to neck or worn as shown in illustration. Ventilated armholes. Ivory buttons. Backed with fancy plaid fast colored woven lining with extra coating of rubber between. All seams sewed, strapped and cemented. 45 inches long. Sizes 34 to 46. Rich Leather Brown shade.

Order by No. F-19. Terms, \$1 with coupon, \$2.10 monthly. Total price, \$13.65.

## 6 Months to Pay

Buy the Elmer Richards way. You can always be well dressed and pay in small monthly sums, so small you will never miss the expense. Money back if not satisfied. No charge for credit. Don't miss this bargain. Supply limited at this special bargain price.

## Elmer Richards Co.

Dept. 1788 W. 35th St., Chicago, Ill.

I enclose \$1. Send Moleskin Cloth Coat No. F-19. Size.....  
If I am not satisfied when I receive the coat I can return it and get my payment back with charges. Otherwise I will pay advertised terms, \$1 with coupon, \$2.10 monthly, Total price, \$13.65.

Name .....

Address .....

Post Office.....State.....

Rain Proof  
Plaid Backed

\$20.00 Value  
Special Price

**\$13<sup>65</sup>**

Pay No  
C.O.D.



Write for our  
Monthly Bulletin of men's,  
women's and  
children's  
clothing and  
shoes.

## How To Make Things Electrical

Have the fun of doing it  
yourself and save  
half the cost

This book gives directions for making hundreds of electrical appliances and devices for the home, the shop and the garage. The simple directions and many drawings make the work easy.

429 pp. Price, \$1.50 postpaid

POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York City

## The Wireless Experimenter's Manual

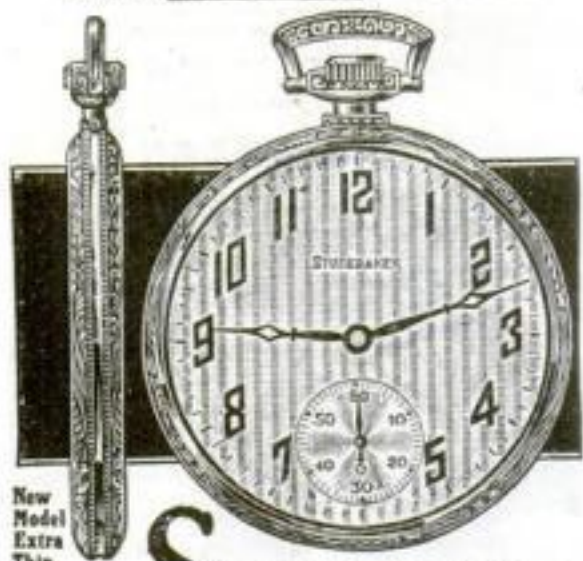
E. E. Bucher

THIS book thoroughly covers the entire field of amateur radio work, including the theory and design of amateur wireless transmitters and receivers, the construction of transformers, high voltage condensers, spark gaps, aeriels, masts, and receiving sets for long and short wave reception. 330 pp. Fully illustrated. Price \$2.25.

POPULAR SCIENCE MONTHLY  
225 West 39th St., New York City, N. Y.



## 21 Jewel ~ Extra thin STUDEBAKER The Insured Watch



New Model  
Extra Thin

# SENT FOR \$1.00 DOWN!

Only \$1.00! The balance in easy monthly payments. You get the famous Studebaker 21 Jewel Watch—Insured for a lifetime; a choice of 54 new Art Beauty Cases; 8 adjustments, including heat, cold, isochronism and 5 positions—direct from the maker at lowest prices ever named on equal quality. Write today for FREE BOOK of Advance Watch Styles.

## Gold Chain FREE!

For a limited time we are giving away FREE with every Studebaker Watch a beautiful pattern Studebaker Watch Chain. Write now while offer lasts.

## Mail Coupon for FREE Book of Advance Watch Styles

Send at once and get a copy of this book—FREE! See the newest, beautiful, advance styles in Studebaker Art Beauty Cases and Dials. Read how you can buy a 21 Jewel Studebaker Insured Watch direct from the maker—save big money—and pay for it on easy monthly payments.

**Write!** for our free book. It will post you on watch styles and watch values. Send coupon at once. Get Free chain offer today while it lasts.

**Studebaker Watch Co.**  
Dept. 2311 South Bend, Ind.



**STUDEBAKER WATCH CO.**

Dept. 2311, South Bend, Indiana

Please send me your Free Book of Advance Watch Styles and particulars of your \$1.00 down offer.

Name .....

Address .....

City ..... State .....

## The Electrician's Wiring Manual

By F. E. Sengstock, E. E.

Contains all the information needed for the proper installation of lighting and power systems in houses and other buildings.

It completely covers inside electrical wiring and construction in accordance with the National Electrical Code.

Pocket size—flexible binding

448 pp. Price \$2.50

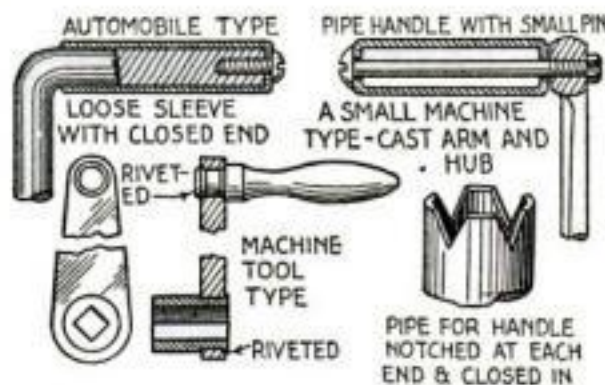
POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York City

## How to Make Simple Cranks and Crank Handles

MANY automobile cranks are bent from round steel stock and fitted with a pin for engaging the notches in the fan pulley of the engine. These cranks usually have a plain hand grip, so that one is apt to get blisters when spinning the motor for any length of time. To overcome this, the writer has fitted his own crank, as well as those of his motoring friends, with loose sleeves, as shown.

The sleeve is a length of thin brass tubing. Notches are sawed in one end of the tube and the prongs are bent to leave an opening that is filed out to fit loosely over a bottomed screw with a large head.

When the wooden handle of the corn sheller, the washing machine, or any other



Three easily constructed crank handles for automobile or machine use

small hand-operated machine splits or breaks, it can be replaced in a somewhat similar manner with a pipe sleeve handle. A short section of pipe is notched at each end, as shown, and these ends are then closed in, leaving a hole for the through bolt that forms the spindle of the crank. Handles of this type have a good grip and will outwear the rest of the machine. They should be oiled occasionally.

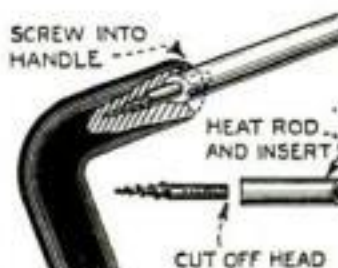
Machine tool cranks, if lost, can be replaced with neat, rugged cranks built of flat and round steel, as illustrated. A long tapered arm or crank web is fitted at its upper end with a handle turned to shape and riveted in place.

The hub or the eye is also turned up out of round steel and has a shoulder that fits against the web. The end of the hub that projects through the bore of the web is riveted over to hold the parts firmly together.—L. F. C.

## Fastening an Umbrella Handle

MY METHOD of fastening a wooden umbrella handle to the steel rod is as follows:

Take a wood screw that has a shank a trifle larger in diameter than the inside of the hollow metal rod and saw off the head of the screw. Heat the rod with a blowtorch or hold it in a gas flame until it becomes red hot. Then quickly insert the shank of the screw in the end of the rod and immerse in cold water. The screw will be fastened securely by the shrinkage and it can then be screwed into the wooden handle. It will be practically impossible for the handle to come off unless it is unscrewed.—JOHN F. JOB, N.Y.



IN ORDER to eliminate interference from telephone and power lines, a radio aerial should be erected at right angles to them.

### World Radio and Auto Batteries

## SAVE YOU 50%

WRITTEN 2 YR. GUARANTEE

We maintain the same high quality material and workmanship found on the most expensive batteries and still are able to allow our remarkably low sale price by greatly reducing our overhead and sale costs.

### "WORLDS OF PERFORMANCE"

Thousands of users enjoy the dependable qualities of our battery. World battery owners "tell their friends". This is our best proof of performance.

### COMPARE THESE PRICES:

Automobile Prices	Radio Prices
6 Volt, 11 Plate - \$12.25	2 Volt. Storage Battery \$5.00
Ford, Chev., Mitchell, Hupp, Grant, Elgin, Vellie, Saxon.	For W. D. 11 and W. D. 12 Tubes
6 Volt, 13 Plate - \$14.00	4 Volt. Storage Battery \$8.00
Overland, Buick, Reo, Paige, Hudson, Nash, Stude., Dort.	(For U V-199 Tubes)
12 Volt, 7 Plate - \$17.00	Same features as 2 volt Batteries. Will run 200 hours on one charge. Rechargeable.
Maxwell, Dodge, Regal, Frank, Briscoe and Crow-Elkhart.	6 volt. 60 Amp. \$ 8.50
Give year and model of car	6 " 80 " 10.00
	6 " 100 " 12.50
	6 " 120 " 14.50
	6 " 140 " 16.00

### SEND NO MONEY

We ship C. O. D. subject to inspection, or will allow 5% discount for cash with order. Shipment made same day order is received. Save 50% on your next battery and get better service and longer life. Our written 2-year guarantee is your proof of satisfaction. Order today—now.

## WORLD BATTERY CO.

Dept. 7

1219 So. Wabash Ave., Chicago, Ill.

## IF YOU ARE DEAF

Or growing deaf and have head noises, don't neglect it! A host of people are to-day overjoyed as a result of a remarkable new kind of ear phone that enables them to hear perfectly not only human voices but the entire range of sounds. They are no longer lonely, unhappy, embarrassed. Thanks to a secret parchment-like diaphragm—the marvellous new tiny ear phone is inconspicuously helping them to communicate with others, and to clearly hear even the faintest musical sounds. Used and highly recommended by thousands of deaf people, to whom you can write. Here is one letter received recently:

"Your instruments have greatly improved my father's hearing. The head noises from which he suffered greatly have completely disappeared. Miss R. Hauptman, 1313 Washington Ave., New York City."

Free Pamphlet tells you all about the ear phone and about the special 10-day offer. Just mail a postal to-day, or if possible call for free office demonstration. Mears Ear Phone Company, Dept. 2011, 45 West 34th Street, New York City.

## Eph-Jay

\$100 a Pair

### HEADPHONE CUSHION

HUDSON-ROSS

123 WEST MADISON ST. CHICAGO

## 10¢ A DAY and Up

### Bargain Prices

#### Celebrated Symphonola Phonographs

Genuine Mahogany, Walnut, or Oak. Portable and cabinet models. 10c. a day and up pays. Plays any record. Write TODAY for Big FREE Book.

**Larkin Co. Inc.**  
Dept. S-1140 BUFFALO, N. Y. PEORIA, ILL. CHICAGO, ILL.



## How to Build a Long-Distance Broadcast Receiver

By Arthur L. Munzig, 6ZJ

Formerly First Class Radio Electrician,  
United States Navy

IF YOU are interested in obtaining long-distance records with a simple one-tube receiver, I can recommend confidently the type of set I have been using at my own station, 6ZJ, at Redlands, Calif., since before broadcasting became popular. With it I have heard repeatedly WJZ, Newark, N. J. (now New York), 2500 miles away; CFAC, Calgary, Manitoba, Can., and KDKA, Pittsburgh, Pa., each about 2300 miles away; KDYS, Honolulu, Hawaii, 2200 miles; WMAQ, Chicago, Ill., and WSB, Atlanta, Ga., both 2000 miles; WOC, Davenport, Ia., and WDAF, Kansas City, Mo., both 1400 miles; KFBJ, Boise, Idaho, and WPA, Fort Worth, Tex., both

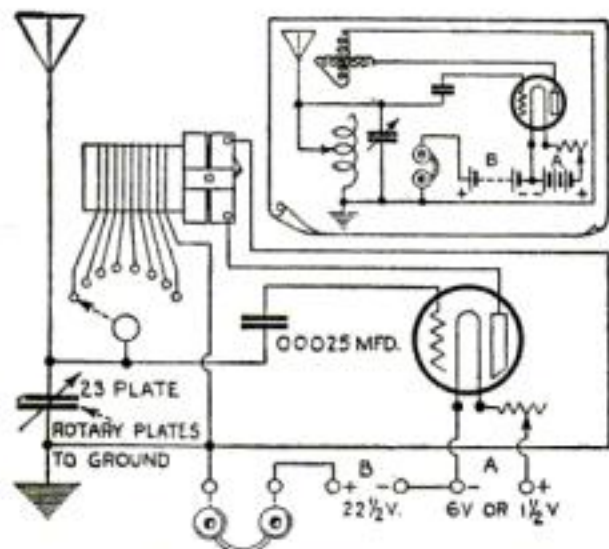


Fig. 1. Two diagrams of the hook-up for a long-distance set, one conventional and the other simplified for the beginner

1200 miles; KDYS, Great Falls, Mont., 1100 miles; KFAF and KLZ, Denver, Colo., KGW and KGG, Portland, Ore., KDZE, Seattle, Wash., all approximately 1000 miles away. Many other stations have also been heard, but they are so close that they are not of much importance from a "DX" standpoint.

The circuit is shown in Fig. 1. It will be seen that the inductance coil and the variometer are in juxtaposition. By thus coupling the grid and plate circuits the radio frequency currents are taken advantage of to increase the strength of signals and incidentally to aid selectivity. The set oscillates and regenerates over the whole range of accessible wave lengths.

Because this is a single circuit receiver do not think that undesirable signals cannot be tuned out. While it is not equal in selectivity to a three-circuit receiver, it is, in my opinion, superior in selectivity to any of the conventional single-circuit designs commonly used. In signal strength it has a considerable advantage over a three-circuit set with only one tube.

The materials necessary for assembling the receiver are:

- 1 variometer
- 1 composition or fiber tube, 3 1/2 in. in diameter, 6 in. long
- 1/4 lb. 22 D.C.C. copper wire
- 8 switch contact points
- 1 switch knob and arm
- 1 grid condenser

(Turn to page 122)

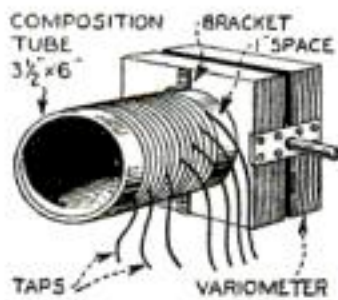


Fig. 2. The inductance coil and variometer

## Men Who Care

### For whiter teeth are now fighting film

Wherever you go among careful people you see teeth that glisten now. Millions of people every day combat the dingy film.

This test will show you how. The results will amaze and delight you. Make it, for your own sake, now.

### Those dingy coats

Film is that viscous coat you feel. Much of it resists the tooth brush, clings and stays. Soon the film discolors, then it forms dingy coats which hide the luster of the teeth.

Film also causes most tooth troubles. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Germs breed by millions in film. They, with tartar, are the chief cause of pyorrhea.

Few people escaped these troubles. So dental science has found two ways to daily fight that film. One acts to disintegrate the film, the other to remove it without harmful scouring.

After many careful tests these

### Protect the Enamel

Pepsodent disintegrates the film, then removes it with an agent far softer than enamel. Never use a film combatant which contains harsh grit.

**Pepsodent** PAT. OFF.  
REG. U.S.

### The New-Day Dentifrice

Now advised by leading dentists  
the world over



### Save Your Tools and Save Money!

A place for every Tool and every Tool in a GERSTNER Case will save both money and Tools. A style, size and price to suit all trades. Catalog free.

**H. Gerstner & Sons**

345 Columbia St., Dayton, Ohio

### BLANK CARTRIDGE PISTOL



Well made and effective model on latest type of revolver. Appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c., superior quality \$1.00 post-paid. Blank Cartridges, by express, 50c per 100.

PRICES  
50c.  
\$1.00

POST-PAID

Johnson Smith & Co., Dept. 14, Racine, Wis.



methods were adopted. A new-type tooth paste was created to apply them daily. The name is Pepsodent. Now leading dentists the world over are urging its adoption.

### Watch its effects

Pepsodent also multiplies the alkalinity of the saliva as well as the starch digestant in saliva. Those agents are there to constantly fight acids and digest starch deposits on teeth. Every use of Pepsodent gives them manifold effect.

Thus Pepsodent does essential things which old ways cannot do. The results are quickly seen and felt. No one can doubt the benefits they bring.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth become whiter as the cloudy coats disappear.

Once learn this way to whiter, cleaner, safer teeth and you will always want them. Cut out coupon now.

### 10-Day Tube Free 1269

THE PEPSODENT COMPANY

Dept. 413, 1104 S. Wabash Ave., Chicago, Ill.

Mail 10-day tube of Pepsodent to

.....  
.....  
Only one tube to a family.

### SENSATIONAL SALE

GUARANTEED TYPEWRITERS  
Limited quantity fully guaranteed standard make typewriters. Five Days Free Trial. Lowest prices ever offered. Easy monthly payments. Send today for FREE booklet of Valuable Typewriter Information and Special Sale Bulletin.  
SMITH TYPEWRITER SALES CO.  
321-360 E. Grand Ave. Chicago, Ill.



### RADIO FANS

Rejoice when using these pneumatic phone cushions. They gently hug the ears, shutting out all room noises. Fits any type headset Money back guarantee if you are not satisfied.

HEADPHONE CUSHION

FANS List of Bargains

FREE POSTAGE FREE 100 PR

RADIO BARGAINS

17 N. LA SALLE ST.-CHICAGO





## The only man who could talk to the Superintendent

"SOON after I began studying," a student wrote to us the other day, "we had a change in management at our plant. I certainly was glad then that I had decided to study in my spare time. For, thanks to my I. C. S. course, I was the only man in the organization who could talk to the Superintendent in his own language. As a result, I was promoted over men who had been here from ten to twenty years. My salary has been increased 90% in the last ten months."

THAT'S a true story of what just one I. C. S. student has done. There are thousands of others. Every mail brings letters from men and women telling of promotions and increases in salary due directly to spare-time study.

One hour a day, spent with the I. C. S. in the quiet of your own home, will prepare you for success in the work you like best. Yes, it will! Put it up to us to prove it. Mail this coupon to-day.

### INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 7661-C, Scranton, Penna.

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

#### BUSINESS TRAINING COURSES

- |  |   |
|--|---|
| <input type="checkbox"/> Business Management                     | <input type="checkbox"/> Salesmanship           |
| <input type="checkbox"/> Industrial Management                   | <input type="checkbox"/> Advertising            |
| <input type="checkbox"/> Personnel Organization                  | <input type="checkbox"/> Better Letters         |
| <input type="checkbox"/> Traffic Management                      | <input type="checkbox"/> Show Card Lettering    |
| <input type="checkbox"/> Business Law                            | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law                 | <input type="checkbox"/> Business English       |
| <input type="checkbox"/> Accountancy (including C.P.A.)          | <input type="checkbox"/> Civil Service          |
| <input type="checkbox"/> Cost Accounting                         | <input type="checkbox"/> Railway Mail Clerk     |
| <input type="checkbox"/> Bookkeeping                             | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary                       | <input type="checkbox"/> High School Subjects   |
| <input type="checkbox"/> Spanish <input type="checkbox"/> French | <input type="checkbox"/> Illustrating           |

#### TECHNICAL AND INDUSTRIAL COURSES

- |   |  |
|---|--|
| <input type="checkbox"/> Electrical Engineering                           | <input type="checkbox"/> Architect                                   |
| <input type="checkbox"/> Electric Lighting                                | <input type="checkbox"/> Blue Print Reading                          |
| <input type="checkbox"/> Mechanical Engineer                              | <input type="checkbox"/> Contractor and Builder                      |
| <input type="checkbox"/> Mechanical Draftsman                             | <input type="checkbox"/> Architectural Draftsman                     |
| <input type="checkbox"/> Machine Shop Practice                            | <input type="checkbox"/> Concrete Builder                            |
| <input type="checkbox"/> Railroad Positions                               | <input type="checkbox"/> Structural Engineer                         |
| <input type="checkbox"/> Gas Engine Operating                             | <input type="checkbox"/> Chemistry <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Civil Engineer                                   | <input type="checkbox"/> Automobile Work                             |
| <input type="checkbox"/> Surveying and Mapping                            | <input type="checkbox"/> Airplane Engines                            |
| <input type="checkbox"/> Metallurgy <input type="checkbox"/> Mining       | <input type="checkbox"/> Agriculture and Poultry                     |
| <input type="checkbox"/> Steam Engineering <input type="checkbox"/> Radio | <input type="checkbox"/> Mathematics                                 |

Name.....  
Street.....  
City..... State.....

Occupation.....  
Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

## Novelty



### Musical Instruments

Not toys—but high-grade practical instruments for Symphony or Jazz orchestras. Great for solo work at Club, Lodge or Legion gatherings or home entertainments. Anyone can play with a few simple lessons, furnished with each instrument.

Musical Pitch Fork Glassophone Jazz-O-Netto  
Mando-Zi Harp Musical Saw Hohner Sax

Free Trial Try any of these instruments for 15 days. If not satisfied, if you can't learn to play it quickly and easily, return at our expense. Remarkably low prices. Easy Time Payments. Send today for new, illustrated catalog describing complete line.

MUSSEHL & WESTPHAL

433 S. Water Street Ft. Atkinson, Wis.

## Building a Broadcast Receiver

(Continued from page 121)

- 1 23-plate variable condenser
- 8 binding posts
- 1 composition panel, 3/16 by 7 by 18 in., or similar
- 1 vacuum tube, any standard type
- 1 socket to suit tube
- 1 A battery, storage or dry-cell, to suit tube
- 1 rheostat to suit tube
- 1 B battery 22½ to 45 volts
- 2 3-in. dials and knobs
- 1 telephone head set
- 1 piece of wood for base

No appreciable difference will be noticed between a storage battery or a dry-cell tube.

The combination inductance-variometer unit is shown in Fig. 2. The tube is wound with 80 turns of the No. 22 wire, a tap being taken at every tenth turn, by the usual method of twisting a small loop. Two small brass angles are used for fastening the inductance coil to the left side of the variometer. This completes the tuning circuit.

The panel layout and the relative position of the instruments are shown in Fig. 3. In making the connections, I used bare copper wire not larger than No. 14, in preference to tinned bus bar.

To operate, connect the antenna lead with the extreme left-hand binding post, and

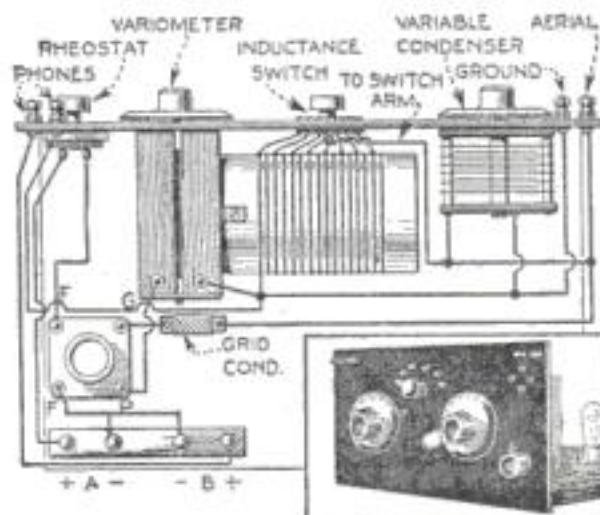


Fig. 3. How the parts are arranged and wired, and the appearance of the finished panel

the ground lead with the post alongside. Then connect the A and B batteries with their binding posts at the rear of the base. These posts should be mounted preferably on a strip of fiber and not directly on the wood. Usually the 18-volt tap of B battery is used, but the voltage varies with different types of tubes.

Slowly turn the detector tube rheostat about three quarters as far as it will go. Connect the telephones with the binding posts provided for them at the right of the panel, try the antenna inductance switch on the various contact points, and turn the variable condenser very slowly from minimum to maximum until signals are heard to best advantage.

To increase the intensity of signals, turn the variometer control to a point where distortion will begin if the dial is moved another degree. How to make the correct settings will quickly be learned with a little practice.

If, after connecting the receiver, it refuses to regenerate on wave lengths of more than 600 meters, reverse the connections with the variometer. It is also well to try reversing the A battery connections.

The utmost pains should be taken in assembling and wiring the set, in order to obtain the best results. One slighted detail may cut down the efficiency considerably.

The writer, being an old ship operator, enjoys listening to the 600-meter traffic, and this set performs perfectly on the wave lengths used for these messages.



## LEARN BY DOING

Every phase of all branches of

## ELECTRICITY

taught by

### Actual Practice

In America's foremost and oldest institution for trade training

### No Books Used

Individual Instruction.  
Start Any Day

Write for FREE 64-page catalog

## THE NEW YORK ELECTRICAL SCHOOL

40 West 17th St., New York City

## NOW Everybody Can Dance

### Learn in One Hour at Home

There's now no need of being a wall-flower. In one hour—at home—by mail—I can make you an easy confident dancer—popular in any ball-room.

#### NEW EASY METHOD

No Partner Needed—No Embarrassment

Over 60,000 men and women have become popular dancers of Fox Trot, One Step, Waltz and all latest up-to-the-minute society dance steps through my new Photo-tell and Photo-tell Method set to music. Amazingly easy—fascinating. No other course like it. I teach you perfect time and rhythm—the secret of good dancing.

#### Six Lesson FREE TRIAL Course on

Convince yourself at my expense how amazingly easy it is to learn modern dancing with my new method. For a short time only I'll send the first six lessons of my course (in plain wrapper) including 10-inch dance instruction record, free and prepaid for five days trial. See, test and prove this remarkable new method in your own home. Then, if not delighted at your success, simply return record and lessons within five days and you'll owe me nothing. Write quick before this unusual offer expires. Please mention make of photograph you have.

WILLIAM CHANDLER PEAK, M. B.

Studio 47, 4601-11 Broadway, Chicago, Ill.

## 20 SHOT 32 CAL. 9.25

SALE  
PROTECT your home with this brand new improved 20 shot, 32 cal. automatic of the finest blue steel. 10 shots with extra magazine, making 20 quick, sure shots in all. Double safety. Special at \$9.25. Also finest type 25 cal. 7 shot blue steel triple safety automatic priced unbelievably low at \$6.95. Both guns shoot any standard automatic cartridge. Money back promptly if Not Satisfied. CONSUMERS CO., Dept. 10-AZ, 1265 Broadway New York

## HAIR GROWS!



When our Vacuum Cap is used a few minutes daily. Sent on 60 days' FREE trial at our expense. Stops falling hair and dandruff. Science combined with common sense. No drugs or electricity. A postal brings illustrated booklet.

### Modern Vacuum Cap Co.

400 Barclay Denver, Colo.

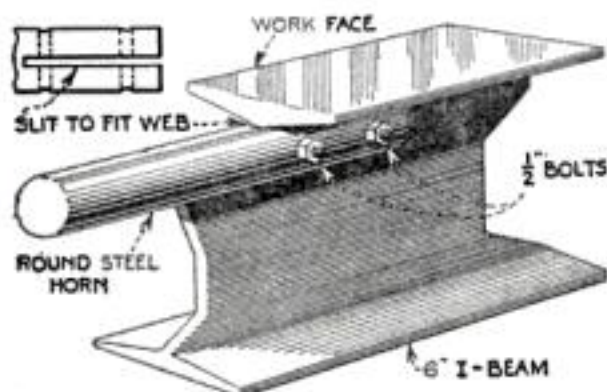


FREE ~ 15 SONGS!



## I-Beam Anvil Cheaply Made for the Small Shop

A SERVICEABLE anvil for the home or farm shop can be made from a piece of scrap I-beam and a short length of round steel. The I-beam usually can be picked up in any structural steel shop for a few cents a pound. It is cut to the shape indi-



For the farm or home shop, this inexpensive anvil serves for many purposes

cated with a hacksaw and the edges are rounded with a file.

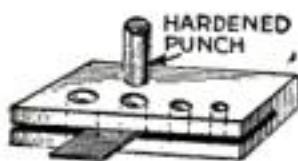
The horn is slotted to pass over the central web and rests on the projecting front support, as shown; two  $\frac{1}{2}$ -in. bolts hold the horn to the anvil proper.

If a tapered horn is desired, take the round iron to a blacksmith's shop and have it forged to a taper. For ordinary use, however, a straight horn serves very well and it can be made in any length to suit special jobs. A long horn makes an ideal riveting anvil for tinsmiths in working up tubes and pipes.

The anvil can be fastened either to a workbench or to a regular anvil base with railroad spikes.—J. R.

## A Quickly Made Punch

PUNCHES of various sizes are often useful about the workshop. The writer recently made a set of five punches by the method illustrated. A slot was cut in a steel plate with a hacksaw and the holes were drilled through. The punches were made of drill rod with hardened ends.



The sheet metal is placed in the slot and the punch is struck a sharp blow with a hammer. This is sufficient to punch holes in 20-mill stock.

## How to Increase the Range of a Small Magnet

IN THE course of some experimental work it became necessary to arrange an electromagnet to exert a considerable pull through a distance which was great as compared with the magnetic field at the poles. The magnet was required to raise a spring-loaded arm through a distance of about  $\frac{3}{4}$  in., but if it had been made large enough to do that, it would have had an enormous excess of pull when the armature was close to the poles and it would also have been too bulky.

The problem was solved by using a small magnet that had ample magnetic pull at a distance of  $\frac{1}{8}$  in. from the pole, and the motion was magnified through an L-shaped lever, the long arm of which had a maximum motion of  $\frac{3}{4}$  in. This idea undoubtedly will be useful to experimenters who meet similar problems, for it saves space, weight, wire, and current and at the same time is easily applied.

# You Can Build Any Model with MECCANO



## Fun That Never Ends

With Meccano any boy can build hundreds of real working models—Cranes, Bridges, Ferris Wheels, Lathes, etc., and have endless fun playing with them.

All the parts are accurately made and are standardized—they fit just where you want them to. No study is needed—you can begin to build the minute you get your outfit. A big book of instructions is included in each outfit.



## Send for this Free Book

It tells about Meccano and the fun of model-building. Sent free to you for the names and addresses of three of your chums. Put No. 65 after your own name for reference.

## MECCANO OUTFITS

No. 00 builds 40 models . \$1.00	No. 2 builds 163 models .. \$6.00
No. 0 " 70 " ... 2.00	No. 2X, with motor..... 8.50
No. 1 " 106 " ... 3.00	No. 3 builds 207 models.... 9.00
No. IX, with motor..... 5.00	and up to \$40.00

For sale by most department stores, toy, hardware and sporting goods dealers. If your dealer cannot supply you, we will on receipt of price.

MECCANO COMPANY, Inc.

Division K-11

ELIZABETH, N. J.

In Canada: Meccano, Ltd., 11 Colborne St., Toronto

\$10.85

## U. S. Army Model 1917 Rifle

Cal. 30, five shot. Barrel 25 1/4 in., total length 46 in., weight 19 1/2 lbs. Barrel and stock new. Sight mounted over receiver. This type used by A. E. F. Price \$10.85. Ball cartridges \$5.50 per 100. Gunners cleaning kit 85 cents. 372 page catalogue 50 cents. Circular for 2 cent stamp. Established 1885.

FRANCIS BANNERMAN SONS, 501 Bway, N. Y. City

## 1 1/2 H.P. \$43.45

Now, a more dependable, durable, powerful engine Direct from Factory at Low Price. 2 1/2, 3 1/2, 5 and 7 horse-power sizes also at a Big Saving.

**OTTAWA**  
EASIEST ENGINE TO START.  
90 DAYS' TRIAL! 10-YEAR GUARANTEE; CASH or EASY TERMS.  
FREE BOOK—*"How to Know Better Engines."*  
Also Special Offer. Write today!  
OTTAWA MANUFACTURING CO.,  
1951Y King St., Ottawa, Kansas.  
Desk 1951Y Magee Bldg., Pittsburgh, Pa.

**\$25 A DAY**  
*Selling Suits*  
Fifth Ave., New York. Custom Tailors want agents to sell advertised brand all wool tailored to measure suits and overcoats direct to wearer. Lowest prices, sell on sight. No capital or experience required. Big line, swatch samples free. Biggest commissions paid daily. Monarch Tailoring Co., 100 5th Ave., Dept. B-2, New York.

## HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will show you how to Protect and Profit From Your Ideas  
Sample copy free. One year's subscription \$1.00. Send for free book.

## "WHAT TO INVENT"

containing Suggestions to Inventors as to Inventions Needed. We invite manufacturers to address us regarding inventions they want.

WORLD PROGRESS PUB. CO., INC.  
Room 202 Victor Bldg. Washington, D. C.



The  
Supreme  
Insulation



## RADION Panels

are  
impervious to  
moisture

Moisture is a conductor of radio frequency currents. When a panel or part absorbs moisture from the air it causes short circuits between terminals. These short circuits reduce volume and frequently are the cause of distortion.

Tests have proved Radion Panels impervious to moisture. Try them and notice the difference.

Send 15c for sample test pieces 2 x 3 inches.

## 18 Stock Size Panels

Radion being an insulation material especially made for wireless use, has the lowest phase angle difference, lowest dielectric constant, highest resistivity and supreme moisture, gas and acid repelling properties.

**American Hard Rubber Co.**  
11 Mercer Street, New York

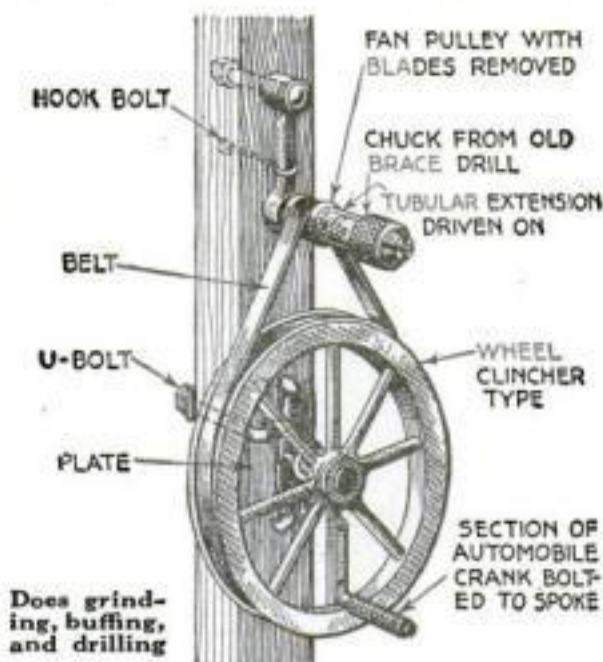
## RADION

Panels-Dials-Knobs-Sockets-Insulators



### Auto Wheel and Fan Pulley Form Grinding Fixture

A DRILLING, grinding, and buffing fixture can be constructed at little cost by using a flanged fan pulley, a clincher type automobile wheel, a ball-bearing spindle, a crank handle, and the chuck from an old brace. With the exception of the



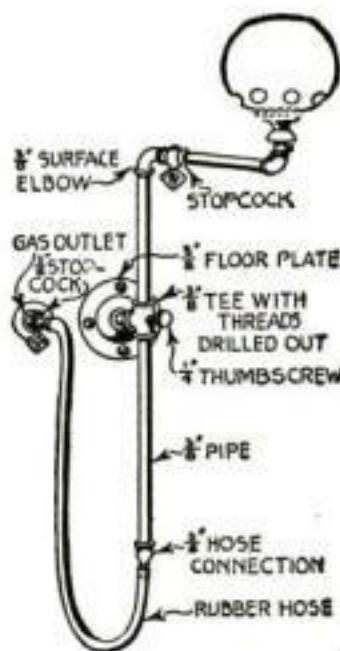
last, these are junk parts from a Ford or other light type automobile.

The wheel is mounted on the spindle and the crank is fastened with bolts to one of the spokes. The fan pulley is mounted on a fan frame bracket. Both these members are bolted in place, as shown, on a wooden column rigidly supported on the shop floor. A leather belt drives the fan pulley, the hub of which is extended by means of a length of pipe for holding the chuck.

### Adjustable Bracket for Gaslight

IN THE workshop that is lighted by gas, it is often difficult to get the proper degree of illumination on fine work at the bench. An adjustable bracket like the one illustrated will usually solve the problem, because it permits the light to be moved up and down and swung to one side or the other as necessary.

Drill the threads out of two ends of a  $\frac{3}{8}$ -in. beaded tee, so that a  $\frac{3}{8}$ -in. brass pipe will slide through snugly. Drill a  $\frac{1}{4}$ -in. hole in the tee and tap it for a thumbscrew to lock the pipe, as shown. Connect a hose stopcock where the bracket was originally connected with the wall, so that when the gas



For workshops lit by gas

is shut off there, the hose will be relieved from pressure. Screw a  $\frac{3}{8}$ -in. floor plate to the wall with a short nipple for the tee.

The gas bracket is fastened to one end of the sliding pipe with an ell, and a hose connection is screwed on the lower end. A length of gas tubing completes the connection. It is perhaps better to omit the bracket stopcock entirely.—L. H. VOTE.

**Sent FREE Upon Request**

Greatest money saving bargain book of our 22 years in the stove business—selling direct from factory to you. Get our price on this beautiful combination Coal and Gas Range finished in blue or gray porcelain enamel.

Mail a Postal Today. Send no money, just your name. Any stove, range, heater or furnace in our book sent on 30 days' trial. Quick, safe delivery guaranteed. Easy payments. Finest quality on earth. Write today.

**Kalamazoo Stove Co., Mfrs.**  
782 Rochester Ave., Kalamazoo, Mich.

**A Kalamazoo Direct to You**

Get Our Catalog and Save Money

### SEND NO MONEY 2 GENUINE DIAMONDS $\frac{4}{100}$ Each

(Cut Stones-No Chips)

**Solid Gold  
\$25**

**14 Kt. White  
Gold Top Gold  
Initial or Em-  
blem Inlaid in**



**Genuine  
Hope Ruby**

**D F G H S M Any Letter**  
This Registered Trade Mark guarantees you genuine diamonds.

Can be had in all initials (Old English); also in all lodge emblems.



Send size of finger and ring will be sent for inspection.

**Buffalo Jewelry Mfg. Co., "The Mail-Order Home"**  
Dept. A, Brisbane Bldg., Buffalo, N. Y.

### ACE TYPE V \$20<sup>00</sup>

**Armstrong Regenerative Receiver**

Licensed under Armstrong U.S. Patent No. 1,113,149

The low cost of this set together with its efficiency and simplicity makes the great demand for it increase daily. A long range receiver. Stations from coast to coast heard distinctly. An ace two-step amplifier in connection with this set at \$20.00 makes use of loud speaker practical. Has Crosley Multistat which permits use of any make tube. Ask for "Simplicity of Radio"—it's FREE. Dealers, write on your letterhead for splendid sales proposition.

**THE PRECISION EQUIPMENT COMPANY**

Powel Crosley Jr., Pres.  
1117 Vandalia Avenue CINCINNATI, OHIO

**FREE RADIO BOOK**

An easily understood explanation of Radio written by Powell Crosley, Jr., President of Crosley Mfg. Co., Cincinnati, and The Precision Equipment Co., Cincinnati.

Write today for this Booklet.  
**CROSLY MANUFACTURING CO.**  
1117 Alfred St. Cincinnati, O.

### MAKE MONEY \$ AT HOME \$

YOU CAN earn \$1 to \$2 an hour writing show cards at home in your spare time. Quickly and easily learned by our new simple "Instructograph" method. No canvassing or soliciting. We show you how, guarantee you steady work at home, no matter where you live, and pay you cash each week. Full particulars and booklet free. Write to-day.

**AMERICAN SHOW CARD SYSTEM LIMITED**  
Authorized and Fully Paid Capital, One Million Dollars.  
206 Adams Bldg. Toronto, Canada.

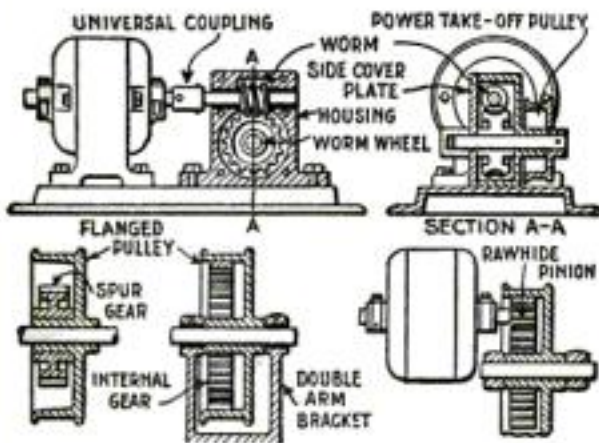


## How to Install Speed Reduction Gearing for Small Motors

By Joe V. Romig

IN USING electric power to drive small machines, the need for an elaborate speed-reducing system of belts and pulleys can often be avoided by utilizing one of the gear drives illustrated. These gear reductions are easily installed, and are neat and satisfactory, especially where space is at a premium.

Washing machines, grindstones, and the like are run at low speed and can be belted direct to a speed-reducing unit, provided that it is designed to give the correct number of revolutions. For very slow speeds the worm and worm wheel are used. The shaft ratio being known, a suitable worm



Three types of reduction units using worm, spur, and internal gearing

and wheel can be bought from a gear manufacturer. The worms and their mating worm wheels can be bought in single, double, triple, and quadruple threads, and almost any range of speed can be provided.

Worm gearing should run in an oil bath, and the casing, therefore, should be made oiltight. One of the best ways of accomplishing this is to build a simple pattern and have the housing cast at a local foundry.

A universal coupling is necessary and every care should be taken to align both shafts accurately. The power take-off pulley should be of the double flanged type, broad and strong, and of such a design that it overhangs the bearing, as shown.

For intermediate or medium speeds an internal gear and rawhide pinion are used; for half motor speeds, a spur pinion and gear will serve. In both cases a bracket with double bearings is used to support the power take-off shaft. The bracket should be fastened securely to a cast iron base and doweled to prevent it from twisting out of alignment with the motor shaft.

In case a spur gear reduction is used, it is advisable to use a rawhide or fabric pinion on the motor shaft to give a quiet and noiseless running.

## Emergency Developing Trays

DEVELOPING trays for either photographic or blueprint work can be made in an emergency from shallow wooden or even cardboard boxes. One method is to coat the box inside and out with hot paraffin wax; the other is to use black asphaltum varnish. The asphaltum makes a good looking as well as serviceable tray.

A cigar box can be used for a small tray by driving a few extra brads into it, giving it a thin coat of asphaltum and alcohol or asphaltum and turpentine and then pouring the thick asphaltum in and running it around until the interior has been thoroughly soaked.—CORA HAMILTON.

## Get your money's worth!



## Music's charms cease when batteries fail

Your radio set works best on near and far stations, only when your batteries are delivering ample current.

Storage batteries, tuned up with Tungar, give the fine results which the owner of a high class radio set is justified in expecting from his instrument.

With Tungar—the go-between from house lighting circuit to storage battery—you do not need to move the battery, or buy a new one. Just attach to a lamp socket or a convenience outlet, turn on the current and leave it, any time, day or night.

Tungar is certain, clean and quiet. There are no moving parts to get out of order or to make noise. Its cost of operation is low.

For years motor car owners have used Tungar for charging their automobile batteries. See one at any good electrical shop, or write for literature. Address Section P 11.

Merchandise Department  
General Electric Company  
Bridgeport, Connecticut

Tungar Battery Charger. Operates on Alternating Current.

(Prices east of the Rockies)

2 Ampere Outfits Complete—\$18.00

5 Ampere Complete—\$28.00

Special attachment for charging 12 or 24 cell "B" Storage Battery—\$3.00

Special attachment for charging 2 or 4 volt "A" Storage Battery—\$1.25

Both attachments fit either Tungar



Charge 'em at Home, with

# Tungar

## BATTERY CHARGER

35A-103D

A GENERAL ELECTRIC PRODUCT

## BURN YOUR NAME ON TOOLS WITH ARKOGRAF

Protect your tools from theft. Write any name, engrave any design on metal with electricity like writing on paper with pen or pencil. Complete outfit \$3.50, prepaid anywhere. Interesting descriptive circulars free. Write to-day. Agents wanted.  
Arkograph Pen Co., 481-A East Couch St., Portland, Oregon

## "DON'T SHOUT"



Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials. THE MORLEY CO., Dept. 797, 26 South 15th Street, Philadelphia

## Be a Newspaper Artist!

Win Fortune and Fame. MANUEL ROSENBERG COURSE IN NEWSPAPER ART tells you how. 71 lessons and 150 illustrations. Drawing made easy. Complete instruction in layouts, lettering, illustration, cartooning and sketching. Ten years' experience as staff artist of important American dailies. Send \$5 or pay the postman C.O.D. Only 2/3 copes left. Order yours TODAY. MANUEL ROSENBERG Butler Building Cincinnati, O.





# Strength!



**T**HIS proves how well Ole Evinrude has protected the Elto light twin against the greatest cause of wear and breakage—the distortion and disalignment of the drive shaft due to striking under-water obstacles. In addition to safety-tilting, the Elto is protected with full floating type drive shaft construction—making shaft distortion or disalignment absolutely impossible.

This exclusive feature, together with the fact that the Elto has double the bearing area of any other lightweight outboard motor, and that its crank and driveshafts are case hardened, finely ground and heavily plated, beyond all question gives the Elto the longest, trouble-free service life.

# Speed!



**R**ECENT British Motor Boat Club International Regatta on the Thames—one Elto entered against European and American outboard motors of all weights and horsepower, Elto wins first place—and prize for covering course in fastest time.

Pacific Coast International Regatta—three mile course in rough open sea. Elto wins first and second prizes against competitive motors of all weights and power.

No obscure races these! Both important International events that prove beyond question the supreme speed of the Elto!

The Elto is the most powerful lightweight motor, the lightest motor per horsepower. It starts as easily as striking a match because it has a big hot spark independent of cranking speed and for the same reason it can be slowed down to real fish-getting trolling speed. Rudder steering. No dangerous pivot turning! Tiller rope control from any part of boat. No shaky, vibrating steering handle. The only 3 H.P. light weight motor—a full extra horsepower over other lightweight motors, the needed H. P. for substantial boats—to buck wind, waves, currents and tides or sudden storms.

Send for catalog—an enlightening booklet—not merely a picture book.

Dealers and Demonstrating Agents wanted. Exclusive Territory. Write for Special Offer.

**Elto Outboard Motor Co.**

Dept. W.  
Manufacturers Home Building  
Milwaukee, Wis.



3 H.P. Fast  
Light Twin

# Elto

## Repairing the Cracked Top of a Hollow Tool Handle

**U**SUALLY the first thing to break in a hollow-handled toolset is the wooden screw top, and without the handle the tool is of little use. Such a break can be repaired, however, in such a way that the top will actually be stronger than when new.



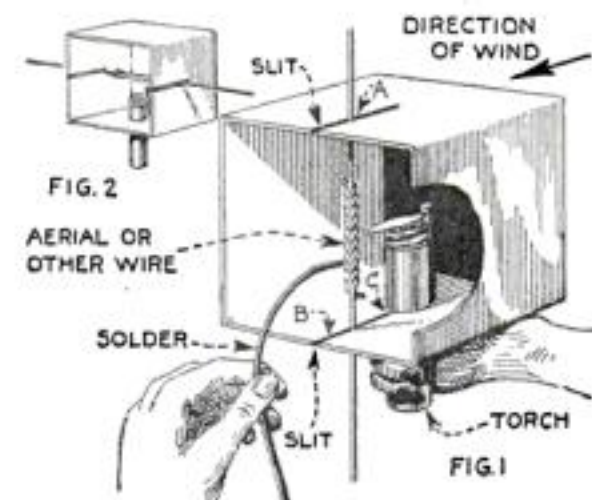
WIRE WOUND IN GROOVE

Wire binds the parts together

Cut a wide, shallow groove around the top at its greatest diameter, apply glue to the edges of the break or cracks, and bind the top together with a smooth, even layer of copper or brass wire of about No. 20 gage. Cut a small groove in the crack, as it were, so that the starting end of the wire can be nipped in the crack without holding the parts away from each other. Finish off the winding by passing the end of the wire twice around the turn that is next to the last and pulling it tight.

## To Solder an Outdoor Aerial in Windy Weather

**W**HEN outside wires, such as a radio aerial, are to be soldered in windy weather, it is impracticable to use an alcohol torch, and often not convenient to use a regular or electric soldering iron. In this event a cardboard box 8 by 10 in. square will serve as a screen to protect the flame of the alcohol torch, and allow it to



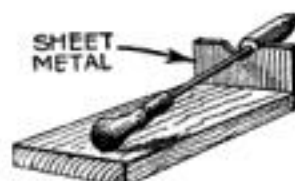
A cardboard box is used as a shield to protect the alcohol flame from the wind

be used almost as efficiently as indoors. One side of the box is open and two sides are slit, as at A and B. A hole is cut for the torch at C.

If the wire runs in a vertical direction, the slits are cut as in Fig. 1, and if it runs approximately horizontal, they are made as in Fig. 2.

## Rest for Soldering Iron

**T**O PROVIDE a convenient place for my hot soldering "iron" when I have put it down for a moment, I use the stand illustrated. This is merely a piece of metal with a V cut in it screwed to the end of a wooden baseboard.—C. F.



WHEN cutting and fitting new windshield glass, a smooth edge is obtained by finishing the cut edge with an old or broken piece of emery wheel.

## CAN YOU

think of a simple, practical idea that will fill one of the many requests we have on file for new inventions? It may mean a fortune for you. Thousands of things are needed RIGHT NOW. Your brains can help. Send today for our great new book—"Inventions and Trade Marks, Their Protection and Exploitation"—and learn more about making money from ideas than you ever knew before. It tells many things that are wanted, too. A postal will do—it is free.

We help our clients, without charge, to get the dollars out of their ideas—having facilities none others possess.

Advice free. Don't delay—get the book at once.

AMERICAN INDUSTRIES, INC.

201 Patent Dept., WASHINGTON, D. C.

**PATENTS ADVERTISED For SALE FREE In INVENTION And MANUFACTURING SUPPLEMENT.**

Published for the man with an idea. Send for free sample copy. One year subscription 50c.

## A Better Radio Battery at Half Price



The Hydrox Radio A Battery is specially designed for Radio use and has been thoroughly tested and approved by leading Radio Manufacturers. You buy direct from the factory and pay only the manufacturer's cost.

Many patented features make the Hydrox superior to any other. A condensing chamber in the cap helps it to retain water longer. A locknut holds the elements firmly in position and prevents seepage.

## A Hydrometer Syringe

is given free with each Hydrox Battery with full instructions for getting the best results. Fully guaranteed for 18 months. Note prices and send in your order today. Cash with order or C. O. D. if desired.

2 Volt 90 to 100 Amp.	\$6.35
4 Volt 70 to 80 Amp.	9.35
6 Volt 70 to 80 Amp.	11.25
6 Volt 90 to 110 Amp.	14.25
6 Volt 130 to 140 Amp.	17.25

Automobile Prices on request.

**HYDROX BATTERY CO.**

2737 Moorman Ave. Cincinnati, Ohio

## \$25.00 in Prizes

See top of page six in front of book for details

## PATENTS

As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 648 F St., Wash., D.C. Estab. 1869.

## PATENTS

TRADE-MARKS, COPYRIGHTS AND PATENT LITIGATION Write for advice and instructions how to proceed, costs, etc. Hand Book with illustrations of 100 Mechanical Movements sent free on request.

**ALBERT E. DIETERICH**  
Patent Lawyer and Solicitor

Successor to Fred G. Dieterich & Co. 60 Ouray Bldg. WASHINGTON, D. C.

## AGENTS—Auto Free

We need special agents to travel by Automobile introducing our great line of Nationally-advertised Pure Food Products, Soaps and Household Necessities. Here is an opportunity to earn \$5 to \$12 a day, all or spare time and obtain an Automobile FREE besides. Write at once for full particulars. Address **AMERICAN PRODUCTS CO.** 8894 American Bldg., Cincinnati, O.

Copyrighted material



## Adding a Radio Frequency Unit

(Continued from page 80)

A is connected with the top end of the stator winding of  $V_1$  and with the G terminal of tube socket 1.

Now connect one rotor lead of  $V_1$  with the switch arm of switch B, one lead of the  $V_2$  rotor winding with the switch arm of switch C, and one lead of the rotor winding of  $V_3$  with the switch arm of D.

Connect the other rotor lead of  $V_1$  with post J. The remaining rotor leads of  $V_2$  and  $V_3$  are joined and then connected with F and I.

Next connect the terminal of  $C_1$  that is nearest to tube socket 1 with the P terminal of that socket and run another wire from the same terminal of the condenser to the top end of the stator winding of  $V_2$ . Make the same connections between similar terminals of  $C_2$  and variometer  $V_3$  by connecting one terminal of  $C_2$  with the P terminal of socket 2 and the top end of the stator winding of  $V_3$ . The remaining terminal of  $C_1$  is connected with the G terminal of tube socket 2 and the remaining terminal of  $C_2$  with the G terminal of tube socket 3.

### The Shields Are Grounded

The P terminal of socket 3 is then connected with E and the wiring completed by connecting the metal shields together and with post J.

If the unit is to be connected with a double circuit set, no changes in the wiring of the set are required. Make sure, however, that the primary circuit is not connected in any way with the other circuits of the set. If the set you are using is of the single circuit type, the grid leak, instead of being connected across the condenser, should be connected so that one terminal connects with the G terminal of the detector tube socket and the other connects with the positive A battery lead. Instead of a direct connection between the ground and the filament circuit, a .001 mfd. condenser should be connected between the ground and the filament circuit.

Since the negative end of the B battery is already connected with the A battery lead, no connection with the negative of the B battery is required from the radio frequency unit.

When the radio frequency unit is to be used, it can be placed either beneath or on top of your standard set and the connections to aerial and ground post of the set made as explained in the beginning of the article. If the use of the radio frequency unit is not desired, disconnect the connections from the aerial and ground posts of the standard receiver and connect the aerial and ground to the standard receiver instead.

### Brings in Distant Stations

After a few evenings' experimenting with the set you will have no difficulty in tuning in stations 1000 miles distant, loud enough so that with the use of the two stages of audio frequency amplification of your set, you will be able to hear the stations on a loudspeaker.

The tuning of the set is comparatively simple. The only really critical adjustments are those of the aerial circuit and the potentiometer. It is best to experiment first on the local stations. Once the approximate adjustments for local stations are found, the controls near these points will bring in the distant stations.

**CLARENCE A. O'BRIEN**  
PATENT ATTORNEY  
REGISTERED IN UNITED STATES PATENT OFFICE  
MEMBER OF THE BAR OF  
SUPREME COURT OF UNITED STATES, COURT OF APPEALS DISTRICT OF COLUMBIA,  
SUPREME COURT DISTRICT OF COLUMBIA, UNITED STATES COURT OF CLAIMS,  
PRACTICE CONFINED TO PATENTS AND TRADE MARKS.

## PATENTS & TRADE MARKS

### Protect Your Ideas

ANY NEW article, machine, design or improvement thereof, or any new combination of parts or improvements in any known article which increases its efficiency or usefulness, may be patented, if it involves invention.

#### If You Have Any New Ideas

which you feel are useful, practical and novel, take prompt action to protect your rights. If you have invented any new machine, or new combination of parts, of improvement, or any new design or process, SEND DRAWING, MODEL OR DESCRIPTION of it for information as to procedure to secure protection.

#### Write Today For Blank Form "Record of Invention"

USE THE COUPON attached, and immediately upon its receipt I shall send you this form to be returned to me with drawing, description or model of your idea; promptly upon receiving your idea I shall write you fully as to procedure and costs.

#### No Charge for Above Information

All communications are held in strict confidence. My personal, careful and thorough attention is given to each case. I offer you efficient, reliable and prompt service—based upon practical experience. Highest references. WRITE TODAY for free book "How to Obtain a Patent." This book will give you valuable information, and it may save you much time and effort. Send for it NOW.

My practice is devoted exclusively to United States and Foreign Patents and Trade Marks. Write me freely, frankly and with full confidence; it is very probable that I can help you. Write TODAY.

**CLARENCE A. O'BRIEN**, Registered Patent Attorney, Washington, D. C.  
345 Security Savings & Com'l. Bank Bldg. directly across street from U. S. Patent Office.

**CLARENCE A. O'BRIEN**, Registered Patent Attorney, Washington, D. C.  
345 Security Savings & Com'l. Bank Bldg. directly across street from U. S. Patent Office.

Please send me your free booklet "How to Obtain a Patent" and blank form "Record of Invention" without any obligation on my part.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
(Write clearly)

**HOW TO OBTAIN A PATENT**

**Detectives in Great Demand**  
**FINGER PRINT EXPERTS WANTED**  
All over the World  
**LEARN SCOTLAND YARD METHODS**

Big Pay, Enormous rewards; we teach you how and arrange a connection for you as soon as you have finished our course. Send today for free booklet telling about SCOTLAND YARD and how to become a finger print expert.

**United Detective Tr. Ass'n,**  
8070 Dinan Bldg. Detroit, Mich.

## U. S. Government Needs Men!

Wonderful opportunities in Civil Service. Thousands of men and women appointed every year. Generous salaries, short hours, liberal vacations. Positions open in Washington and in every other city of the country, as well as in Porto Rico, Alaska, Hawaii and the Philippines. Write to-day for 48-page FREE BOOKLET on CIVIL SERVICE, which tells you how you can get a good-paying position with the United States Government.

INTERNATIONAL CORRESPONDENCE SCHOOLS  
Box 7663-C, Scranton, Penna.

## FREE FIRST LESSON RECORD

### Learn to Play

Violin, Mandolin and Banjo—Mandolin quickly. No embarrassment. You learn to play or pay nothing. Play for money in two months.

**Beautiful Instrument FREE**

No charge for instrument to one pupil in each locality. Few cents a week pays for lessons. Write for First Record—Sent without cost on 1 week's approval with complete details of Personal Instruction Record Course.

**SCHNEIDER SCHOOL OF MUSIC**  
Dept. C-11, 228 Vermont Street, Blue Island Ill. (A suburb of Chicago)

### Special 5 Size Tap and Die Set, Only \$3.00

**DIRECT FROM THE FACTORY TO YOU!**

Our No. 12 Automobile Set furnished in our highly finished chestnut box contains 5 each taps and dies (1-4, 5-10, 3-8, 7-16, and 1-2"), in the S. A. E. thread, 1 die stock, and one tap and reamer wrench.

Our No. 11 Set is the same as No. 12 except that the thread is U. S. B. instead of S. A. E. You are purchasing a splendid set at a very low figure. Send us your order at once and be one of our many satisfied customers.

Let us also send you one of our circulars illustrating our full line of Handy Tools.

**WORCESTER STEEL PRODUCTS CO**  
Dept. M., 29 Union Street, Worcester, Mass., U. S. A.





## HIGH SCHOOL COURSE IN TWO YEARS

### YOU ARE BADLY HANDICAPPED

if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

### FIT YOURSELF FOR A BIG FUTURE

This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

### USE SPARE TIME ONLY

Most people *idle* away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

### American School

Dept. H-875  
Drexel Ave. and 58th St., Chicago

#### American School

Dept. H-875, Drexel Ave. & 58th St., Chicago  
Send me full information on the subject checked and how you will help me win success.

- |                              |                            |
|------------------------------|----------------------------|
| .....Architect               | .....Lawyer                |
| .....Building Contractor     | .....Machine Shop Practice |
| .....Automobile Engineer     | .....Photoplay Writer      |
| .....Automobile Repairman    | .....Mechanical Engineer   |
| .....Civil Engineer          | .....Shop Superintendent   |
| .....Structural Engineer     | .....Employment Manager    |
| .....Business Manager        | .....Steam Engineer        |
| .....Cert. Public Accountant | .....Foremanship           |
| .....Accountant and Auditor  | .....Sanitary Engineer     |
| .....Bookkeeper              | .....Surveyor (& Mapping)  |
| .....Draftsman and Designer  | .....Telephone Engineer    |
| .....Electrical Engineer     | .....High School Graduate  |
| .....Electric Light & Power  | .....Fire Insurance Expert |
| .....General Education       | .....Wireless Radio        |
| .....Vocational Guidance     | .....Undecided             |
| .....Business Law            |                            |

Name.....

Address.....

### Unique Lead-Pencil Holder Prevents Waste Motions

ANY one who constantly uses a lead pencil at a desk or drafting table can save much time by keeping it in a holder made as indicated by boring a slanting hole in a block of wood. The hole should be large enough so that the pencil fits easily and loosely into it and at an angle identical



The pencil is always at an angle ready for writing and no time is lost in picking it up from the desk

with that in which the pencil is used for writing.

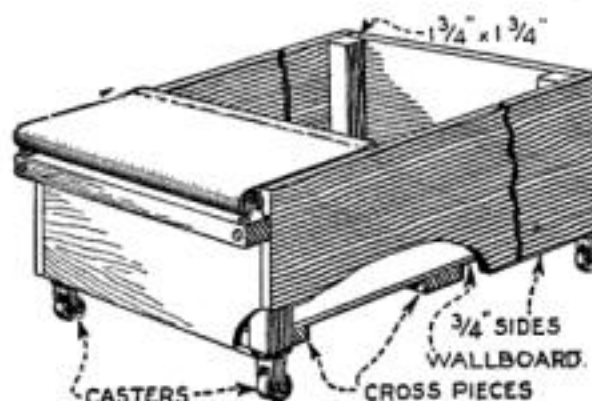
I have found that this is a time-saving "kink" because it enables me to pick up the pencil and write immediately. The method used by most people who write is to lay the lead pencil down on the table so that it must be picked up and moved around until the fingers get it into the usual writing position.

With this holder the pencil is always in the correct position and useless motions are eliminated.—W. F. SCHAPHORST, M.E., Newark, N. J.

### Roomy Under-Bed Storage Box Costs Little to Make

IN CROWDED quarters it is possible to make use of the waste space under the bed for storage purposes, provided a light, roomy and dustproof box is built to slip underneath. Such a storage box can be constructed quickly and cheaply by the method illustrated.

Obtain four pieces of  $\frac{3}{4}$ - or  $\frac{1}{2}$ -in. wood to form the sides of whatever size box you



This simple storage box, which can be made any convenient size, is covered with an ordinary window shade

wish to construct. Then screw or nail them together at the corners to  $1\frac{1}{4}$ -in. square pieces, as shown. Three wooden strips are fastened to the bottom of the frame, one in the center and one at each end, and a wall-board bottom is tacked in place.

An ordinary shade is used for the cover, the roller being fastened to a wooden strip at the rear of the box. Chair casters or, if preferred, cheap, rubber-tired bassinet wheels are provided so that the box will roll easily, no matter how heavy the contents.—C. M.

## U.S. PATENTS



### DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.



274 Ouray Bldg.  
WASHINGTON, D. C.  
Originators of forms "Evidence of Conception."

## PATENTS

### To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

**RICHARD B. OWEN**  
Patent Lawyer

6 Owen Building, Washington, D.C.  
2276-D Woolworth Building  
New York City

### 800 Men Wanted to Learn AUTO PAINTING Make \$50 to \$300 a Week and more

Experience not necessary—we teach by practical experience every operation in automobile painting, including color varnishing and stripping, in eight to ten weeks.

**EARN WHILE LEARNING**  
Get our earn while learning plan. We get you a job. 10,000,000 AUTOMOBILES NEED PAINTING  
Factories are calling on us for men and are paying eight to fifteen dollars a day. Many of our graduates work for a while in the factories then

**START A BUSINESS OF THEIR OWN**  
No capital is needed except a few brushes and some paint and D. A. P. S. Training. Every town needs more paint shops. Detroit, the center of the automobile industry, is the place to learn automobile painting; our instructors were selected from painting engineers of the big factories. Auto factories employ our methods and employ our men.

Write for FREE Catalog and information. Do it today.  
**DETROIT AUTO PAINTING SCHOOL**  
411 D. A. P. S. Bldg., 1471 Van Dyke St., Detroit, Mich.

## PATENTS

BOOKLET FREE  
PROMPTNESS ASSURED  
HIGHEST REFERENCES  
BEST RESULTS

Send drawing or model for examination and report as to patentability  
**WATSON E. COLEMAN, Patent Lawyer**  
624 F Street N. W., Washington, D. C.



## Neat Screw Heads Reveal the Skilful Mechanic

**A**MATEUR mechanics too often overlook one simple but important matter—the appearance of the heads of screws. It is not always easy to get all screws without marring them, especially if they are driven hard, and this applies as well to machine as to wood screws, and to nuts and bolt heads. One good plan, when it is necessary to remove and replace screws frequently during construction, is to use an entirely new set of screws for the final assembly.

Incidentally, too little importance usually is attached to the screwdriver. It is an important tool. The mechanic who has any regard for his work or for his tools will always use a screwdriver that fits well in the screw slot, without taper. There is nothing so hard on screws as a driver with a taper-ended blade. Furthermore, such a tool will not transmit maximum power to a screw in a hard drive, for it will slip out. A driver that fits properly will break a screw head before it slips, if it is big enough for the job.

Polished screw heads add much to appearances, and ordinary iron screws can be made to look almost like nickel-plated ones if a little polishing is done. A lathe, though convenient for polishing, is by no means necessary. Just as good a job can be done by putting the screw in the chuck of a drillstock, placing the stock in the vise, and turning the drill while polishing the screw head with fine emery cloth. Short rods can be polished in the same way.

The ends of nuts also can be polished in the drillstock, but the faces are best finished by working them on emery cloth laid on a perfectly flat surface. Better yet, glue the cloth to a piece of wood. When the abrasive becomes worn, make another and keep the old one for finer work.

Oval-headed screws often add much to the appearance of a piece of work and in many cases they are not readily obtained. A flat head can be made into an oval head by the simple process of using a fine file on the head as it rotates in the lathe or drillstock, and finishing with emery cloth.

Another way to obtain a good effect is to bevel the head of a filister-headed screw, using the same process, but working carefully in order to get a clean, sharp bevel. If the screw head is painted or enameled red or black—all except the bevel, which is left bright—the effect is attractive.

**T**HERE is one man who is very careful to take out all the tubes in his radio set before he changes connections. He is the one who has burned out one or more bulbs by accidentally connecting his B battery voltage across the filaments of his tubes. It is good practice to test across the filament terminals of a socket before inserting the tubes, either with a voltmeter or a test lamp consisting of a flashlight lamp, socket, and two flexible leads.



Suggestions for polishing and chamfering screw heads, and an improperly tapered screwdriver

# PATENTS TRADE-MARKS AND COPYRIGHTS

## SPECIAL OFFER FREE OPINION AS TO PATENTABLE NATURE



Before disclosing an invention, the inventor should write for our blank form "**Record of Invention.**" This should be signed and witnessed and if returned to us together with model or sketch and description of the invention, we will give our opinion as to its patentable nature.

## Our Three Books Mailed Free to Inventors

Our Illustrated Guide BOOK

## HOW TO OBTAIN A PATENT

Full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

## OUR TRADE MARK BOOK

Shows the value and necessity of Trade Mark Protection and gives information regarding *Trade Marks and unfair competition in trade.*

## OUR FOREIGN BOOK

We have Direct Agencies in all Foreign Countries. We secure Foreign Patents in

shortest-time and lowest cost.

## List of Patent Buyers Sent Free

IDEAS WANTED: Send for LIST OF PATENT BUYERS, containing unsolicited Letters from Manufacturers and others WISHING TO BUY meritorious patents. There is a great demand for NEEDED INVENTIONS. We endeavor to assist OUR clients in the commercial development of their inventions.



Specification and Drafting Departments, Victor Building, Washington, D. C.

**FREE  
Coupon**

## VICTOR J. EVANS & CO. Patent Attorneys

New York Offices 1007 Woolworth Bldg. Philadelphia Offices 714-715 Liberty Bldg. Pittsburgh Offices 514 Empire Bldg.  
Chicago Offices, 1114 Tacoma Bldg. San Francisco Offices, Hobart Bldg.

Main Offices, 760 9th Street, Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name.....Address.....



DON'T MISS THIS CLUE

## "The Radio Detective"

Arthur B. Reeve's thrilling new story of CRAIG KENNEDY, Famous Scientific Detective, Begins in the October

BOYS' LIFE

THE BOY SCOUTS' MAGAZINE

Ask your newsdealer today or write to  
200 Fifth Ave., N. Y.

By subscription \$2 a year

### Convenient Sewing Screen Costs Little for Materials

THE sewing screen illustrated, which was designed by the United States Department of Agriculture, takes up little room, is light in weight, can be carried wherever needed, and is inexpensive to construct. It consists of two panels 13 1/2 in. wide and 28 in. high, hinged together.

The panels are simply frames of 1 by 2 in. wooden strips covered with burlap. A



The sewing screen open, showing the work shelf and equipment

small wooden drop shelf with bracket support is the only other woodwork necessary.

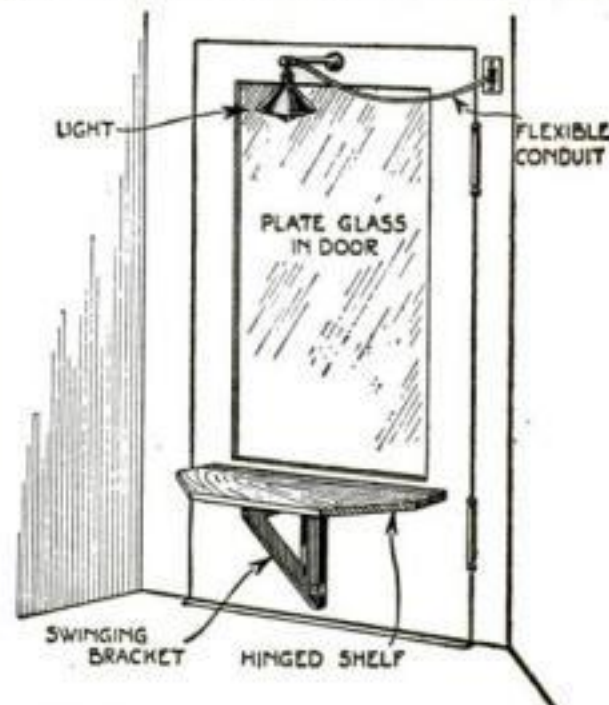
The materials required are:

- 10 ft. lumber, 1 by 2 in.
- Six 1 1/4-in. butt hinges with screws to be used in joining the panels and fastening the drop shelf to the cross pieces
- One handle with screws for top of screen
- One hook and eye to fasten panels when they are closed and folded
- 2 yds. burlap, denim, or canvas, 18 in. wide
- 1 doz. brass cup hooks
- 1 yd. of cretonne for pockets
- 1 yd. of 1/2-in. elastic for top of pockets
- 4 doz. upholstering tacks for tacking burlap
- Sandpaper and stain.

The screen can be equipped with sewing materials to suit the needs of the user.

### Shop Door Used for Display

A SHOP door can sometimes be used effectively for special evening window displays. This is accomplished by hinging a shelf to the back of the door, as shown, and



Special merchandise is placed on the shelf to supplement window displays in the evening

supporting it with a swinging bracket. A powerful light is mounted on the ceiling directly above or on a swinging arm.—M. C.

### "LIGHTING FIXTURES"

Ready to hang.  
Direct from manufacturers.  
Completely wired including glassware.  
Send for Catalogue No. 24 and Dealers' proposition  
**ERIE FIXTURE SUPPLY CO.**  
Desk A, Erie, Pa.



### You Can Save \$35.00

Recover it yourself.  
**\$4.45 and up**  
Custom tailor made to fit all makes and models. Roof and quarters sewed together, with rear fasteners, welts and tacks, complete. Anybody can put it on. Give name, year, model number of your car. Catalog FREE. Agents wanted.  
**LIBERTY TOP & TIRE CO. Dept. SE Cincinnati, O.**

## Law Course in Book Form

13 Vols. Bound in Law Buckram. Compiled by 56 of America's Most Eminent Legal Authorities. Here is a complete home-study law course in book form that you can master in your spare time. Thirteen volumes, nearly 6,000 pages (7 x 10 inches), bound in law buckram, red and black labels with titles in gold. This wonderful law course is the combined work of professors of Harvard, Yale, Pennsylvania, Michigan and Wisconsin law schools.

### Study at Home, Aided by Free Reading Course

Every principle of law is made clear. Fascinating reading course of 25 Texts (free with the books) is a teacher, right at your elbow! A set of review questions covers the text matter fully.

**75c a Week** You get the entire 13-volume law library and Complete Reading Course of 25 pamphlets for only 75 cents a week. See offer in coupon.



MAIL THE COUPON

American Technical Society, Dept. L-820, Chicago, U.S.A.  
Please send "Library of American Law and Practice" and Reading Course for seven days' examination, shipping charges collect. I will send \$2.50 within seven days and \$3.00 a month thereafter until I have paid \$49.50 or return the books at your expense.

Name .....  
Address .....  
Employed by .....



Warren Radio Loop, Cut Away to Show Construction.

### A Better Set with a Better Aerial



Sharper Tuning  
One tuning adjustment—no others needed.  
Directional  
Receives signals strongest Selective  
Picks out just the station you want to hear.

Portable  
Small, light, compact. Ideal for portable and mobile sets.  
Wider Range of Frequencies  
On single coil.  
Small re-radiative effect. Fine for regenerative circuit.

### A TYPE FOR EVERY SET

Type-A-737 (300-700 meters) 6 inches square—non-directional \$10  
Type-A-7236 (175-1000 meters) 6 inches square—non-directional \$12  
Type-B-2537 (300-700 meters) 18 inches square—directional \$20  
Type-BL-2520 (200-18,000 meters) with honeycomb coil mounting, 18 inches square—directional, \$25

Send for Bulletin U-102

V-DE-CO RADIO MFG. CO. Dept. O, Asbury Park, N. J.



## Positive Clutch Simply Made for Small Machines and Models

By Howard Greene

IN EXPERIMENTAL mechanics and model work it often is desirable to use a positive clutch for throwing the driving power on or off. The easily built device illustrated answers this purpose well.

While the clutch can be applied in a variety of ways, one example will make the principle clear, so that the experimenter can adapt it to his own work. Assume that the driven shaft of the machine has a projecting end upon which a pulley (or gear) is mounted. The first step is to remove the key, pin, or setscrew and make the bore sufficiently large so that the pulley will run freely on the shaft. It is kept in place by a pinned or setscrew collar.

A steel pin or a machine screw with a plain shank is inserted in the pulley, as shown. If a machine screw is used, the head is cut off after insertion.

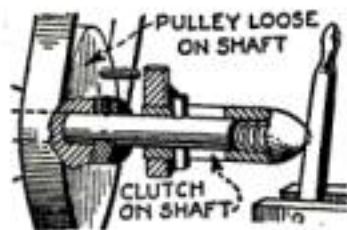


Diagram of the clutch

Drill the shaft, beyond the collar, for a tightly fitting steel pin that will project on both sides, but do not yet drive the pin. Over the end of the shaft fit a piece of heavy tubing that will slide easily, but without much shake. Slot the tube at diametrically opposite points, so that when the tube is in place on the shaft and the pin is driven in, the tube will slide lengthwise, but will be prevented by the pin from rotating in relation to the shaft. For very light work, a single pin and a single slot will suffice.

Leave part of the tube projecting beyond the shaft, and plug the end, after inserting a light coiled spring in the space between the plug and the end of the shaft. On the opposite end of the tube, pin a collar with a projecting arm. If the tube is heavy and the work light, a pin screwed into the tube will answer. This is to engage the pulley pin.

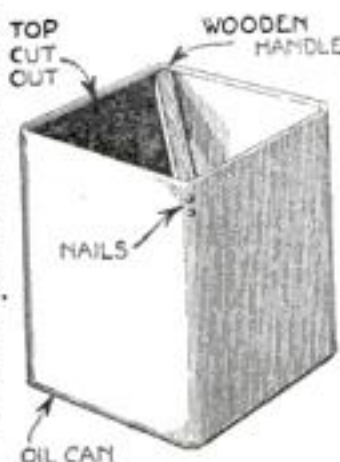
If the pulley is driven by a belt, it rotates on the shaft idly, but a push on the end of the sliding tube moves the arm to a point where it is picked up by the pin on the pulley, and the shaft is then driven. When pressure on the tube is released, the spring automatically throws out the clutch.

If something more complete in the way of control is required, a lever can be made as shown. The end of the tube is brought to a rounded point so that it will turn freely against the lever, which should be relatively broad. A regular collar and fork may also be used, but will not work better.

## Tin Buckets for the Shop

THERE always seems to be a shortage of buckets around the home garage.

Buckets are used for holding drained oil, for washing parts, for holding bolts and screws, and the like. A supply of buckets, however, can be made up readily from empty square oilcans by cutting off the tops and fitting wooden handles as shown at right.—J. E.



# PATENTS

## Seventy-six Years of Practice

THE firm of Munn & Company filed its first application for a patent in 1846, and for seventy-six years has endeavored to keep pace with the inventive genius of the United States. An experience of many years is at your disposal. If you have an invention which you wish to patent, send your sketches or model together with a description of your device, explaining its operation, and you will receive prompt, courteous attention.

## Write for our Handbook on PATENTS

A full and complete booklet on Patents, Designs, Trade-Marks, Foreign Patents, Copyrights, Labels and Patent Office Practice with an explanation about our methods, terms, etc.

*All communications strictly confidential*

Keep in touch with the inventions of the world by reading  
**SCIENTIFIC AMERICAN**

The MONTHLY MAGAZINE with a special appeal to every man of inventive genius. Recent rulings of the Patent Office, descriptions of the latest patented inventions, legislation and court decisions affecting patents, are noted in this authoritative publication.

## MUNN & COMPANY

### Patent Attorneys

683 Woolworth Building, New York City

Scientific American Bldg., Room 3, 625 F Street, Washington, D.C.

801-D, Tower Building, Chicago, Ill.

602 Hobart Bldg., San Francisco, Cal.

## \$25.00 in PRIZES

See top of page 6 in front of book for details

# PATENTS

IF YOU HAVE AN INVENTION and DESIRE TO LEARN HOW TO

SECURE A PATENT, send for Our Guide Book, HOW TO GET A PATENT, sent free on request. Tells our Terms, Methods, etc. Send model or sketch and description of your invention and we will give our opinion as to its patentable nature.

NAME.....

STREET.....

CITY.....STATE.....

**RANDOLPH & CO.**

130 F St., N. W., Washington, D. C.





A TELESCOPE is a neverending source of interest at your home, country-club, mountains, or seashore. American-made; as fine as money can buy. See one at your dealer's. Booklet on request.

## Bausch & Lomb TELESCOPE

*Every sportsman should have a pair of Bausch & Lomb Binoculars as well.*



**Bausch & Lomb Optical Co.**

Rochester, N. Y.

New York Washington Chicago San Francisco London

## Attractive Built-In Bench Made for a Window Corner

By M. Langsdorf

BUILT-IN benches made by the home worker often add to the beauty and individuality of a home. They fit especially well in a window corner, such as the one illustrated, or on a porch.

The interior bench shown was built in a corner of a small alcove to form a maga-



Built on exceedingly simple lines, this window bench costs little and gives added attractiveness to a small room

zine nook and to give added seating room. A simple cut-out scroll is added to break the plain lines, while an inexpensive stock molding above and baseboard below finish



A unique built-in porch bench that supports flower boxes and a trellis for vines

the top and bottom. The seats and backs slant to make them more comfortable.

The boards were cut at the mill the exact size needed, and therefore it was comparatively easy to put the bench together.

Two open sides of the bungalow porch also were beautified by built-in benches, fitted between the columns and the house.

## Perforating Blank Forms

A SHEET of wire window screen and a knife or needle are all that are necessary to perforate paper or cardboard forms. The forms are laid on the screen and, if paper, a needle is drawn along a straight edge at the desired place. For heavier cards a sharp knife is used. The angle at which the cutting instrument is held and the mesh of the screen determine the fineness or coarseness of the perforation.

This expedient was found to work well in perforating the return blanks of a large number of shop forms when the regular perforator was not available.—H. E. B.



**Layer  
Wound  
and  
Layer  
Insulated**

## Stromberg-Carlson Radio Head Sets

are wound a layer at a time, with insulation wrapped between each layer. This is the reason why Stromberg-Carlson Head Sets stand up under high plate voltages.

Other features of the Stromberg-Carlson Head Sets are—

The receivers are balanced as to volume—both ears get the message.

The ear caps cover the ears—excluding outside noises.

The adjustment rod telescopes and therefore does not catch the ladies' hair.

Ask Your Dealer

**Stromberg-Carlson  
Telephone Mfg. Co.  
Rochester, N. Y.**

## CLASS PINS

**FREE CATALOG** GIVE NAME OF SCHOOL OR CLUB AND NUMBER IN CLASS  
Either pin illustrated made with any 3 letters and 2 figures, 1 or 2 colors enamel Silver plate, 25¢ ea., \$2.50 doz. Sterling silver, 40¢ ea., \$4.00 doz. Write for catalog of sterling and solid gold pins and rings.  
Bastian Bros. Co. 542 Bastian Bldg., Rochester, N.Y. 3529

## BE A HOTEL EXECUTIVE

Earn \$2,500 to \$12,000 a Year

**STARTS at Almost  
Double Present Salary**

One student (name on request) writes: "I have gotten the position as Steward for the \_\_\_\_\_ at a salary of \$250 per month with free house and board." He received this position before completing our course, having formerly held a job in a logging camp. His employer writes: "He is certainly the right sort of fellow and has been well trained. We feel that he will get along very well with us." Another student writes: "I had not been under your instructions two months before you placed me here at the \_\_\_\_\_ Hotel." This is not unusual. Leading hotels everywhere want our graduates, men and women, for responsible well-paid positions.

### Let Us Train You



Prepare for this fascinating work in spare time at home. No previous experience necessary. Cost is moderate!  
**EASY TERMS**  
Training endorsed by leading hotel executives. We help you get a position. Write today for full information.

Standard Business Training Inst.  
Carlton Court,  
Buffalo, N. Y.



Send me Free Booklet H-167 giving full information about Hotel Operation and Management Course, also Employment Bulletin.

Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_



## 60% of Market Price Hundreds of Diamonds



This 5-8-3-32 Ct. diamond solitaire (absolutely genuine) of snappy, fiery brilliancy at \$38 is just one of hundreds of equally amazing offers in recent diamond bargain list. Never throughout three-quarters of a century have we been able to offer more startling values.

Yet the reason should be clear. This 75-year-old firm through its soundest of policies has an ever growing business. This largest and oldest diamond banking institution of its kind in all the world has the highest rating and over \$1,000,000.00 capital. We have made loans on diamonds, jewels, etc., in excess of \$25,000,000 and still doing an ever increasing loan business.

**\$38**  
5/8-3/32 Ct.  
TRY TO MATCH  
AT \$70.00

## Why Pay Full Prices

Costs Nothing to See

At our risk we send you any bargain on approval for absolutely free examination. You'll be more than satisfied to buy when you try to match at 60% more. Hundreds of the loans unpaid must be sold now. Diamonds, jewels, other gems (also watches) of unusual qualities at unusual startlingly low prices based on loan values not the regular market values. Diamonds as low as \$100 per Ct. Still more desirable qualities at \$125 per Ct. and upward.

**\$189**  
1-5/32 Ct.  
Blue-White

**\$55**  
2 Ct.  
Show Cluster

## Loan LIST FREE Now

Edition limited. Don't delay. Write at once for latest bargain bulletin—includes loans unpaid. Entirely different listings—unpaid loans and other special advantage bargains in vast array pictured and described in full detail—exact carat weight, color quality, etc. Diamond bargains with guaranteed cash loan values. Unlimited exchange privilege at price paid on. Get details of Free Examination Offer. No obligation. List is Free. Send postcard or Mail Coupon NOW

Jos. DeRoy & Sons,  
Only Opposite Post Office  
4714 DeRoy Bldg., Pittsburgh, Pa.

Without obligation, send me free, your latest Bargain List of Diamonds, Watches and other jewelry.

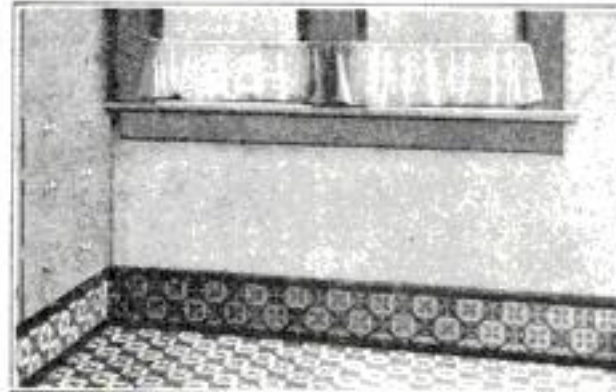
Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

(Continued from page 134)

## Linoleum Baseboard

A KITCHEN can sometimes be made more attractive, and at the same time easier to keep clean, by using linoleum in place of or to cover the ordinary wooden baseboard. If the baseboard is old and badly scratched and worn, this is an improvement well worth the cost.

The quarter round molding that is almost invariably used as a finish between the



The ease with which this baseboard can be kept clean and its neat appearance recommend it for the modern kitchen

wooden baseboard and the floor, is removed, as well as the molding along the top edge of the baseboard. The nails are carefully taken out through the back or cut off, not driven through the face of the molding. Strips of linoleum are then cut a trifle wider than the baseboard and tacked or cemented in place. The upper edge is turned over the top of the baseboard and the molding replaced. The lower edge is similarly concealed by nailing the quarter round molding into the corner.

## Painting Floors

PAINTING floors is usually considered a disagreeable type of manual labor because of the backaches that almost invariably result when one attempts to do the painting while standing up, or the sore knees caused when one does it while kneeling. The writer has tried both methods and does not like either. Recently, while painting the porch floor, he asked himself, "Why not sit down?"

A simple stool was made, as illustrated, out of a 1-in. board, about 8 in. square, a



The one legged stool

2 by 4, 1 ft. long, and some cloth. The cloth was wrapped around the lower end of the 2 by 4 to protect the floor from scratches.

A one-legged is preferable to a three-legged stool, because it permits considerable movement and enables one to cover a large area of floor before making a move. The weight mainly rests upon the stool and the legs are used only for maintaining the balance and shifting around from place to place.—N. G. NEAR.

## A pipe-smoker's challenge to other smokers

Is there a smoker in the audience who can answer this one

Nearly every smoker is particular about the kind of tobacco that goes into his pipe. While he may smoke a pipeful from a friend's pouch for the sake of companionship, for day-in and day-out smoking he prefers his own brand.

And yet if you ask the average smoker what it is he likes about his tobacco, he may have difficulty in answering you.

Mr. Joe Rivers, whose letter follows, is a confirmed Edgeworth smoker. In attempting to describe what he likes about Edgeworth, he coins the word "tasty-smellfulness." But as this does not entirely satisfy him, he puts the question up to other Edgeworth smokers.

Larus & Brother Company, Richmond, Va. Gentlemen:

Being a pipe smoker of no mean experience (having tried most pipes and pipe tobaccos) I've watched your smokers' letters in the magazines for some explanation of a taste that for me applies only to Edgeworth.

It is extremely difficult to describe this, because it seems to come as the smoke filters through the mouth and nostrils at the end of a draw from the pipe—a sort of combined "tasty-smellfulness" that most satisfies the smoke appetite.

Why don't you get some of your smokers who can write, to describe this.

Sincerely yours,

(Signed) Joe Rivers.

Probably there are any number of reasons why men smoke Edgeworth. One friend actually admitted he smoked it because his wife liked the shape of the Edgeworth glass jars to fit on her pantry shelf.

However, the one outstanding feature of Edgeworth, as seen by most smokers, is its uniformity. Year after year smokers can be sure of getting the same high-grade quality of tobacco.

If you have not tried Edgeworth, send your name and address to Larus & Brother Com-

pany, 59 South 21st Street, Richmond, Va. They will be glad to mail to you some free samples, generous helpings of both Edgeworth Plug Slice and Ready-Rubbed.

If you will also include the name and address of your regular tobacco dealer, your courtesy will be appreciated.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug slice or Ready-Rubbed for the same price you would pay the jobber.



## PERFECT CONNECTIONS



are always sure with Fahnestock Patent Wire Terminal Grips Like a Vise Eliminates Vibrations Easily Attached No Soldering Best of All for RADIO OUTFITS

Clip No. 45 (illustrated) especially adapted for bus wire

Made in all Sizes and Shapes At your Dealer's

FAHNESTOCK ELEC. CO.

East Ave. and 8th St. Long Island City, N.Y.

## Sell Shirts

Sell Madison "Better-Made" Shirts, Pajamas, and Nightshirts direct from our factory to wearer. Nationally advertised. Easy to sell. Exclusive patterns. Exceptional values. No experience or capital required. Large steady income assured. Entirely new proposition. WRITE FOR FREE SAMPLES. MADISON SHIRT CO., 603 B'way, N.Y. City





## The FLORSHEIM SHOE

The many men who wear Florsheim Shoes select them for what they are, not for what they cost. Made for those who want a high standard of quality at a reasonable price.

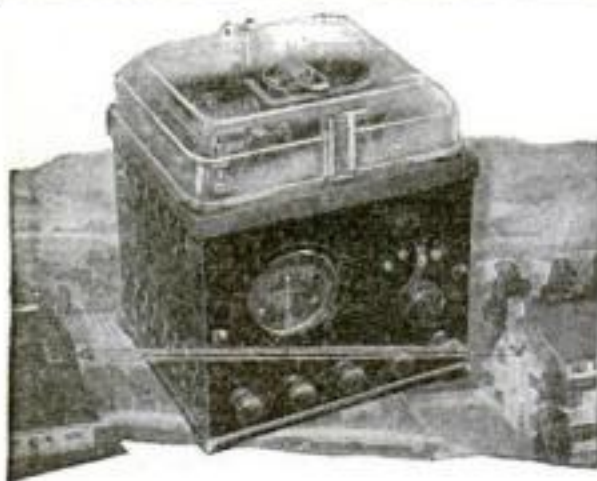
Most Styles \$10

Booklet "Styles of the Times" on request

THE FLORSHEIM SHOE COMPANY  
CHICAGO

The Rialto

Style M-128



## ONE CHARGER for Every Radio Battery

—And, in fact, *the only one* which you need. Keeps strong clear signals in your set by keeping the batteries to full capacity.

The Valley Type ABC Battery Charger is made for all storage batteries—2-volt peanut tube batteries, 6-volt A Batteries and 1 to 4 B Batteries. Bakelite panel, glass top—belongs to a radio receiving set.

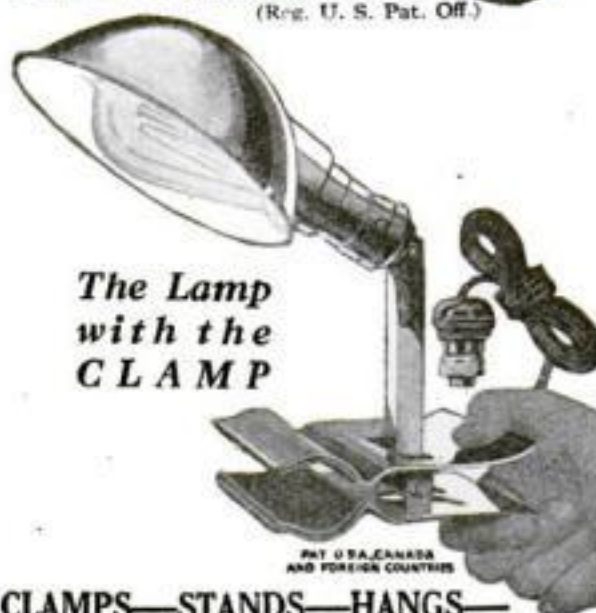
Frankly, production is limited. Late buyers are going to be disappointed. A lot were last year. Ask to see the Valley Type ABC Charger at any good radio shop.

VALLEY ELECTRIC CO.  
3157 S. Kingshighway St. Louis, Mo.

**Valley Battery Charger**

## Adjusto-Lite

A FARMERWARE PRODUCT  
(Reg. U. S. Pat. Off.)



The Lamp  
with the  
CLAMP

### CLAMPS—STANDS—HANGS—

Projects a better, clearer, more direct light exactly where you need it. No glare—no eyestrain—and perfect lighting comfort—in home, office, store, studio, workshop, laboratory. Solid brass; a quality product throughout. Clamp is felt-lined—can't scratch. 5 yr. guarantee. Complete with 8 ft. cord and 2-piece standard plug, \$5.

Make sure you get the genuine Adjusto-Lite. The name is on the carton and on the clamp. Sold by live dealers everywhere.

If your dealer cannot supply you, order direct.

S. W. FARBER  
141-151 S. Fifth Street, Brooklyn, N. Y.

Prices in U. S. & Canada, brass \$5; bronze, nickel, or white enamel finish, \$5.50. West of Mississippi River, 25c higher.

## Small Radio Condensers Made from Enameled Wire

WITH nothing more than two enameled wires, a fixed condenser for radio receiving of practically any ordinarily required capacity can be made within two or three minutes' time. The wire can be any gage from 14 to 24. Two short lengths are twisted together and connected as illustrated. How much wire to be used can be found quickly by trial.

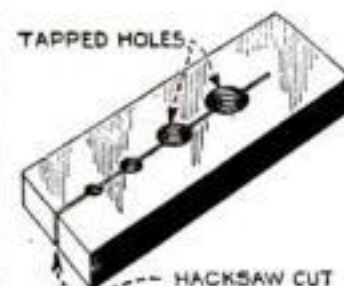
The enameled insulation has a high dielectric strength and consequently a condenser of high capacity is formed by twisting the wires in this way. Two lengths 6 in. long are sufficient for making a fixed condenser that is generally useful in the average experimental radio set.



A cheap condenser

## Cutting Off Machine Screws

THE amateur machinist is constantly cutting off small machine screws to suit the work in hand. Time can be saved in doing this if a small clamp, made as shown, is used. It is simply a piece of cold rolled steel drilled, tapped, and split with a hacksaw.



The screw-holding plate

To use this fixture, put the screw to be cut into the proper hole and place the clamp between the jaws of the vise. The screw then can be cut with a hacksaw or file and the end chamfered ready for use. The clamp also can be used as a gage for cutting a number of screws to the same length.—H. G.

## Model Airplane Propeller

IN MAKING toy airplanes, air driven hydrosleds, and similar models, the home worker is often puzzled as to the best way to make a strong, good-looking propeller. Frequently these are carved out of the solid, but it is really easier and more effective to make them laminated.

If possible, use alternate layers of whitewood or pine and walnut or mahogany. For a propeller  $\frac{3}{4}$  in. thick, use five plies; in any case, use an odd number so that the mahogany or walnut can be placed on the outside.

Cut and plane the pieces alike, drill them in the center, and then spread them apart fan shape, as shown. Spring each piece out sufficiently to run hot glue between them and clamp them together until the glue hardens. Carving the propeller then becomes a simple matter.—E. C. J.





This One



EYFL-NDK-Q66W







## Conquests of Metal and Coal

(Continued from page 48)

In early times, even in the days of the greatness of Egypt and of Rome, there was no steam power. All power came from slaves. The bulk of the Pyramids and the great stones of the Coliseum were raised by the muscles of men. Oxen and horses helped a little, but not much. It remained for the men of the last 300 years to save their own labor and do all this work with coal.

It began a little earlier than that, with a monk who went off to pick blackberries one day in the summer of the year 657. Near the monastery of Glastonbury, in England, where this blackberrying monk happened to live, there was an old and long abandoned stone quarry. Many blackberry vines grew there and that was where the monk went. In the course of his day's adventures he chanced across a piece of curious black stone which he took with him to the monastery to show it to the prior.

Now the prior had no desire to be bothered with strange stones picked up by foolish monks in blackberry patches. He threw the black stone impatiently into the fire.

Then came the astonishment. The stone caught fire and burned. The prior, to do him justice, could see a fact when it was simple enough. He quietly bought the quarry, and the "black stones" replaced wood as the monastery fuel. The secret was kept, they say, for over a hundred years. Only this one house in all the world was heated by coal.

### Coal Becomes a Common Fuel

But in the end, of course, the secret leaked out. Coal began to be used for fuel all over England. One by one, beds of it were discovered elsewhere in the world, and it became a common fuel among the well to do.

Every one is familiar with the rest of the story. The power of steam had been known to many ancient scientists. An Egyptian temple, for example, had possessed an apparatus that opened the doors of the shrine when a fire was built on the altar so that it heated a steam chamber placed beneath. Hero, the great experimenter of Alexandria, had built a kind of revolving engine propelled by escaping jets of steam.

But all this had been forgotten. Steam was rediscovered by James Watt and his teakettle. It was applied in Cornwall to drive the pumping engines that lifted water out of the tin mines. Step by step, the use of the new power was extended and improved, multiplying by scores and then by hundreds of times the work that can be done by a single man.

With the perfection of this use of steam we arrive at present times—at the Age of Coal and Iron that was promised when man found his first gold bead in the streams; that came nearer with the discovery of copper tools; that reached its latest turning point when the monk of Glastonbury brought home the first lump of coal.

Later developments of the use of power, such as the gasoline engine and electricity, do not belong in this story. They are, of course, part of the evolution of the world, of man's growing control of it. But they were inevitable once man had made the great discovery of metals and the still greater discovery that he could secure from

(Turn to page 142)



Nothing speaks so eloquently of HOMCHARGER satisfaction as the fact that thru sheer merit alone it has become the *standard* by which all other battery chargers are judged. Over 125,000 HOMCHARGERS already in use offer the most convincing proof that it is the most efficient, economical and fool-proof battery charger at any price.

#### A NEW TRADE-MARK FOR A TRIED AND PROVEN PRODUCT

Its phenomenal success has led to the introduction of many inferior and make-shift imitations. To insure our reputation and protect the buying public against substitution, the Radio De Luxe HOMCHARGER henceforth will be sold under a new Trade-Mark, viz.:



Retaining the same fundamentally correct operating principle and beautiful appearance of our Radio De Luxe model, it is a step nearer ultimate perfection through adoption of several construction refinements dictated by the policy of Progress.

#### HOMCHARGER'S 10 POINTS OF SUPERIORITY

1. Simple—Only one moving and wearing part, replaceable after thousands of hours use for \$1.00. Will last a lifetime.
2. Efficient—Uses less than one-half the current of any bulb or liquid type rectifier. Will charge any radio or automobile battery for a nickel.

#### DEALERS!

GOLD SEAL HOMCHARGERS will outsell any other radio device this season. "GOLD SEAL Business Builders" illustrates many attractive sales helps and explains how we are prepared to co-operate with the Trade in making this a "HOMCHARGER Year." Send for your copy and Trade Discounts, TODAY.

#### JOBBERS!

Popularly Priced—Retail at \$18.50 complete (\$22.00 Canada). No extras to buy. Sold by all dealers.

FREE BROADCASTING LIST. Send today for Free List of Broadcasting Stations, and Circular Describing the Gold Seal Homcharger.

**Insist**  
on the **GOLD SEAL**

It is your protection against substitution. When buying order by name and verify by the GOLD SEAL, which appears on the carton as well as the nameplate.



The Automatic Electrical Devices Co., 131 West Third St., Cincinnati, O.

Largest Manufacturers of Vibrating Rectifiers in the World

### 5 SQUARES IN 1 TOOL

TRI, OCTAGON, BEVEL, ACUTE, and PROTRACTOR Square all in one handsome tool. Locks instantly



and automatically at ANY ANGLE desired. Convenient, accurate, a time-saver. Always ready. Strong, durable, simple. If you use a saw you need this



#### SIMORE "Lightning Change" TRY-SQUARE

With 4½ or 6 inch blade.....\$3.75  
With 7½ inch blade, postpaid.....\$3.90

Money back if not satisfied.

Dealers are invited to write for our proposition on this tool and the Simore "Lightning-Change" Screw-driver. Watch for our next "Lightning-Change" Tool.

THE SIMON & SKIDMORE MFG. CO.  
Dept. 511 Santa Ana, Calif.

**\$1.97**

Direct Factory Price for Limited Time Only

**Duble-Heat ELECTRIC STOVE**

Newest, neatest, most economical of all Electric stoves, the Duble-Heat does your cooking quicker, better, cheaper. Toasts, fries, boils in half usual time. Full size heating surface. New metallic treatment reflects back ground to heating element utilizes all the heat. Operates on any lighting socket, direct or alternating current.

Direct From Factory on Approval

**SEND NO MONEY**

Amazing offer! Only \$1.97—and on approval! Just pay postman upon arrival, plus a few cents postage. One year full durability guarantee. If not delighted, return in five days, and every penny refunded. Order quick! Only limited number at this introductory price.

Acorn Brass Mfg. Co., 1135 Factory Bldg., Chicago, Ill.





### It Bridges the Vastness of Space

SINCE Marconi first successfully spanned the Atlantic Ocean, with the wireless telegraph, radio has ever been outstanding as an invention of unlimited importance to humanity.

In 1909 the broadcasting of that now famous distress call, CQD, from the sinking passenger liner, S. S. Republic, established in the eyes of the entire world the tremendous importance of radio on the high seas.

In 1912, when the gigantic liner, the S. S. Titanic, struck an iceberg far from shore, in the north Atlantic, with thousands of passengers aboard, it was the SOS call of her wireless that brought rescue ships from all parts of the ocean. Here again radio demonstrated to the world its great service in the saving of human life.

During the war communication controlled the destinies of armies. Here radio played an exclusive part in the establishing of communication between ships at sea, from ship to shore, and from aeroplane to ground, where the use of wires was impossible.

In recent years the development of the vacuum tube has not only improved radio for the purpose of marine, commercial and military communications, but through radio telephony and public broadcasting, has established a new and even greater service to humanity.

Cunningham Vacuum Tubes are the product of years of research and experimental work by the Engineers of that great scientific organization, the Research Laboratory of the General Electric Company.

Cunningham Tubes are standard for all makes of receiving sets. Each of the numerous types have been designed to operate with maximum efficiency in one or more of the various applications of vacuum tubes to the radio art.

#### A SPECIALLY DESIGNED TUBE FOR EVERY RADIO USE

##### CUNNINGHAM RADIO TUBES

C-301A—6 Volts 1/4 amp. Amplifier.....	\$6.50
C-299—3 Volts .06 amp. Dry Battery Det. and Amp.....	6.50
C-300—6 Volts Gas Content Detector.....	5.00
C-11—1.1 Volts .25 amp. Dry Battery Det. and Amp. Special Base.....	6.50
C-12—Similar to C-11 with standard base.....	6.50

Home Office  
248 First Street  
San Francisco, Calif.

154 West Lake Street  
Chicago, Illinois

20 Church Street  
New York City, N. Y.

**Patent Notice:** Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08, and others issued and pending. Licensed for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.

*E. J. Cunningham Inc.*



## Conquests of Metal and Coal

(Continued from page 141)

coal or elsewhere vast resources of mechanical power so that he himself would not have to work so hard.

We come back, then, to the thought with which I began this chapter. Materials and power, iron (which is our most necessary material), and coal, are the things that make possible the present life of the world. They multiply the power of man. One man, on the average, can produce more food or distribute more food than one man could ever do in the previous history of the world. And so there is more food. More people can live in the world and can live, on the whole, more happily. Material civilization, to us who have come so recently from a war, may not seem an unmixed blessing. But when one strikes a balance between the bad things it has done to us and the good things, the result I think, is good. The world is not perfect but it is better off than it ever was before.

And this, when one stops to think it out is about all that evolution means.

### Evolution Leads Us Onward

But evolution, as I have said, keeps on. If the world on the whole is not now so badly off, have we a chance that it may be still better? The evolutionist's answer is an emphatic yes.

There are vast sources of useful power that are still untapped—water power, the power of the tides, power from the inside of atoms. Perhaps there are materials, too, that wait to be discovered—new metals or alloys, cheaper and better building materials, improved substances for tools, none of which we dream of now, any more than the savage who found the first copper in the ashes of his fire dreamed how far that find of his would lead the world.

The progress of discovery did not stop with the sifting of those ashes. There is no reason to think that it will stop now.

## In This Issue

	Page
Men of the Hour in Science.....	21
The World's Ten Greatest Scientists.....	25
An Interview with J. Arthur Thomson.....	26
Monorail Airway to Relieve Traffic.....	31
Flightless "Flights" Test Aviators.....	33
Ford Distills Coal for Motor Fuel.....	34
By Raymond J. Brown.....	34
How to Learn Radio while You Sleep.....	36
Happiness in Hobbies.....	37
Why I Employ a Health Manager.....	38
An Interview with Samuel M. Vauclain.....	39
Printing Made Audible for the Blind.....	40
Science—A Modern Sherlock Holmes.....	42
By Richard E. Enright.....	42
Self-Stabilizing Airplane.....	43
Professional Donors of Blood.....	46
By Robert E. Martin.....	46
Conquerors of Metal and Coal.....	47
By E. E. Free, Ph.D.....	47
Railway Coaches May Take Wing.....	48
Inventive Science Comforts the Sick.....	51
Are You in the Right Job?.....	53
By Herbert A. Toops, Ph.D.....	53
Tools of the Insects.....	55
By Ernest Bade, Ph.D.....	55
Bridge-Dam Harnesses Tiny Stream.....	57
From France to England through Tube.....	58
Talking by "Wired Wireless".....	60
Vacuum Tubes and Their Uses.....	61
By Jack Binns.....	61
Our Fickle Sun.....	62
By Scriven Bolton, F.R.A.S.....	62
Danger—High Voltage.....	64
By George M. Ogle.....	64
More Household Ease and Efficiency.....	65
Home Movies with New Paper Film.....	66
The Great American Voice.....	68
By R. W. King.....	68
The New Four-Wheel Brakes.....	71
What the Balloon Tire Offers.....	71
Oil Transmission Replaces Gears.....	71
New Accessories for the Auto Owner.....	71

The Home Workshop..... 79

Better Shop Methods..... 82

## Prices Reduced On All Standard Make TYPEWRITERS



Lowest Prices in Years  
We will ship any make you choose for one week's trial. Underwood, Royal, L. C. Smith, Remington, Oliver, etc.

**Easy Terms**  
Pay less than rent each month and own a typewriter. Guaranteed as good as new. Perfectly rebuilt by experts—the famous "Young Process." Send for our free trial offer and new low price list now. WRITE TODAY.

**Young Typewriter Co.**  
World's Largest Dealers in Standard Typewriters  
654 W. Randolph St., Dept. 142B, Chicago, Ill.

### DIAMONDS - WATCHES - CASH OR CREDIT

**Genuine Diamonds GUARANTEED**

Send for Catalog. Everything fully explained. Over 2,000 illustrations of Diamonds, Watches, Pearls, Gold Jewelry, Silverware, Mesh Bags, etc.

**Wrist Watch, 18-K Solid White Gold, 17 Jewels, guaranteed, \$35; 15 Jewels, 14-K, \$29. Terms, \$1.00 a week.**

**SEND FOR CHRISTMAS CATALOG**  
The Old Reliable Credit Jewelers  
DEPT. F871  
100 to 108 N. State St., Chicago, Ill.  
BROS & CO. 1823  
Stores in Leading Cities

Wonderful bargain at \$100 Terms \$2.50 a week

"Sylvia" Diamond Ring. Blue white, perfect cut. Diamond Ring 18-K Solid White Gold. \$100. Others at \$75, \$125, \$150, \$200, and up.

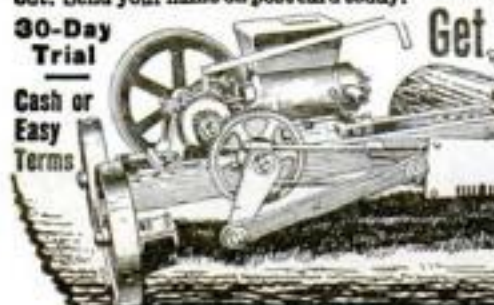
**LOFTIS**

## Saws as much as 10 Men!

Now, you can saw 15 or more cords of wood each day with the OTTAWA Log Saw. With wood selling at \$3.00 a cord, owner makes \$45.00 a day. Send for SPECIAL OFFER, now.

**NEW MODEL:** Write for Special Introductory Offer and advanced information about the wonderful new model OTTAWA—just out. Send your name on post card today.

30-Day Trial  
Cash or Easy Terms



Fastest sawing; easier moved—easy to start in any weather. 4H-P KEROSENE ENGINE—you need all this power. Shipped quick from nearest to you of nine branch houses at low factory prices.

**OTTAWA 4 in 1 LOG SAW**  
1—FALLS TREES 3—BUZZES UP BRANCHES  
2—SAWS LOGS 4—DOES BELT WORK

Get BIG Factory-to-User Offer!

Send for Big FREE 32-Page Book, Special Offer and Low Prices. Write today.

**OTTAWA MFG. CO.**  
1805 H Wood St.  
Ottawa, Kansas.  
Room 1805 H  
Magee Building  
Pittsburgh, Pa.

Now Improved OTTAWA



## MAGNAVOX Products

EVERY condition in the art of radio reproduction is most successfully met by Magnavox apparatus.

### Reproducers

R2 with 18 inch horn \$60.00

R3 with 14 inch horn \$35.00

M1 with 14 inch horn; for dry battery sets . \$35.00

### Combination Sets

A1-R consists of Magnavox Reproducer with 14 inch horn and 1-stage Amplifier . . . \$59.00

A2-R same with 2-stage Amplifier . . . \$85.00

### Power Amplifiers

A1-One-stage . . 27.50

AC-2-C-Two-stage 55.00

AC-3-C-Three-stage 75.00

Radio users will be sent new 32-page Magnavox Radio Catalogue on request.



The new Magnavox Combination Sets A2-R [2-stage] and A1-R [1-stage] insure the utmost in convenient, perfect home radio reproduction.

A special device permits instant control of volume to suit the size of room, character of program, etc.

## Current Events by Magnavox Radio

TODAY, an education comes to stand for growth, the schoolroom is no longer the student's world, but the world is the student's schoolroom—and we are all students.

A Magnavox in the home means a liberal education and daily entertainment for old and young.

For the requirements of those who own dry battery receiving sets, the new Magnavox

Reproducer M1 (semi-dynamic type) is supreme in its class. Where storage battery sets are used, the new Magnavox Combination Sets (as illustrated) give the utmost in appearance, adaptability and efficiency.

Magnavox Products are for sale by Registered Magnavox Dealers Everywhere

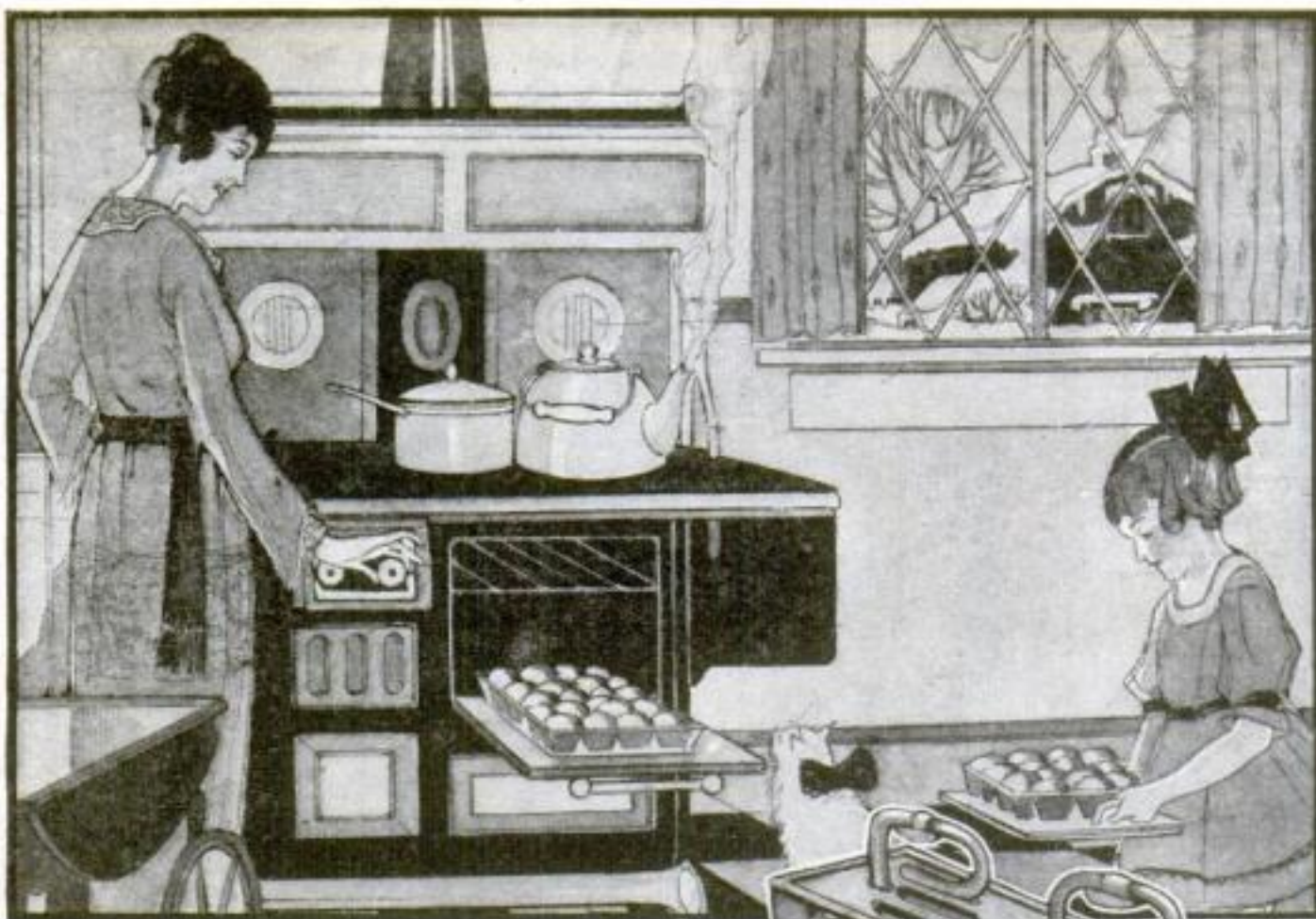
THE MAGNAVOX COMPANY, Oakland, Calif.

New York Office, 370 Seventh Avenue  
Perkins Electric Co., Ltd., Canadian Distributors

# MAGNAVOX PRODUCTS

*There is a Magnavox for every receiving set*





Makes every range a gas stove—much or little heat—at turn of valve.

# Amazing Invention

## New Cheap Fuel Replaces Dirty Coal and Wood in any Stove!

No more dirty, heavy coal and wood to lift and carry—no more dirty scuttles—no more clouds of ashes and dust to breathe and muss up the house—no more cold, unevenly heated rooms—no more worry about coal strikes and exorbitant prices. An amazing invention ends all this forever!

### 3 Times the Heat of Coal

**A**LREADY over 150,000 housewives have equipped their stoves with this wonderful new device—the Oliver Oil-Gas Burner—that actually gives **3 times the heat of coal.** What a difference to have this clean, even heat eliminating hours of daily drudgery—any degree of heat, at a minute's notice, by simply turning a little valve.

#### 95% Air—5% Oil

And, at the same time you are saving money because only 5% oil is combined with 95% air to form a clean, odorless, smokeless, blue-white flame. Your housework is cut in half. Your curtains, rugs and draperies will stay bright and clean twice as long.

#### AGENTS AND DISTRIBUTORS

Oliver representatives make big money—\$500.00 and more a month. Thousands of spare time workers, agents and salesmen are needed—\$75 a week easy. Exclusive territory—real co-operation. Write at once for Free Sample Case Offer, interesting literature and full details. No obligation. Write B. M. Oliver, President, at address below.

#### Fits Any Stove

Mr. Oliver's Invention is made in 16 models to fit any type or size of range, heating stove, or furnace. No holes to drill, no changes what-

ever in your stove. It is so simple a child can operate it. So sturdy it will last a lifetime. Absolutely safe. Perfect heating satisfaction guaranteed.

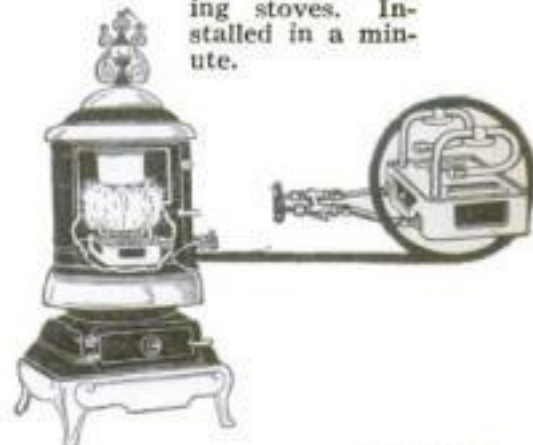
#### Special Low Price Introductory Offer

Don't face another winter depending on uncertain coal supply. (Government statistics show that there has been a strike every year for 10 years.) Don't go on spending hours each day emptying ashes, cleaning and regulating a mussy stove, or running downstairs all day long to regulate and replenish the furnace fire. Don't risk your family's health with uneven, uncertain coal or wood heat. You can have Mr. Oliver's wonderful invention at a Special Low Introductory Price—use it in your own stove under a guarantee of perfect satisfaction Mr. Oliver is now making to readers of this magazine. You will be entitled to this offer if you fill out and mail the coupon below immediately. You will receive full details and an interesting Free Book, "New Kind of Heat." No obligation. So mail it at once.

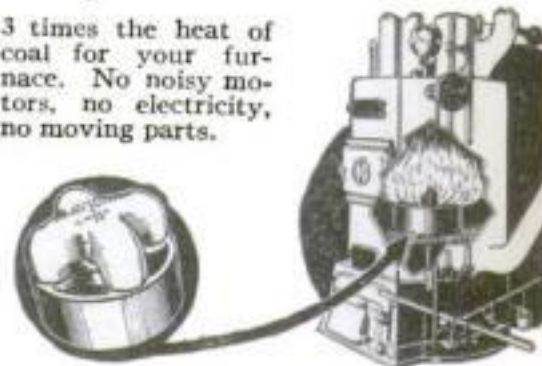
## OLIVER OIL-GAS BURNER

OLIVER OIL-GAS BURNER CO., 2007-K Oliver Building, ST. LOUIS, MO.  
Canadian Distributors: 2007-K Oliver Building, Toronto, Ont.

Puts intense, hot flame in all heating stoves. Installed in a minute.



3 times the heat of coal for your furnace. No noisy motors, no electricity, no moving parts.



OLIVER OIL-GAS BURNER CO.  
2007-K Oliver Bldg., St. Louis, Mo.

Send me your FREE Book, "New Kind of Heat," and Special Low Price Introductory Offer. I am interested in a burner for a

☐ Coal Range ☐ Heating Stove ☐ Furnace (Specify Steam, Hot Air or Hot Water)

Name .....

Address .....

City ..... State .....





# Now— you can own the famous FADA NEUTRODYNE RADIO SET

**F**OR half what a good complete regenerative set costs you can now own the famous Hazeltine Neutrodyne Set that all the radio editors in the country are so enthusiastic about.

Jack Binns said, in July Popular Science Monthly, "Professor Louis Hazeltine, one of the foremost radio experts of the country, has succeeded in silencing the shrieks, groans and whistles of regeneration that have marred the enjoyment of supersensitive receiving sets."

Professor Hazeltine's wonderful invention permits the reception, in great volume, of concerts, speeches, singing, sermons and all the other interesting things the air is filled with.

Not only does the Hazeltine-Neutrodyne Circuit eliminate squeals, howls and shrieks, but it also receives clearly radio concerts from distances of 1,000 miles and more. You can hear New York in Chicago—Toronto in Texas—Schenectady in St. Paul—and all on the loud speaker.

## MR. B. W. DOWNS TELLS HIS EXPERIENCE

Bertram W. Downs of St Paul, says:—

"A word in appreciation of the Neutrodyne parts and your instruction booklet. I just finished building a 5 tube set according to your instructions. Herewith are some of the results obtained last night, between the hours of 9 and 10 P. M.

"Direct comparison was made with a 3 tube regenerative set on the same aerial, using the same batteries and tubes. The test was made at Bald Eagle Lake, 20 miles from WLAG, the Twin City Station, which was in operation all during the test.

"The 3 tube regenerative set brought in Chicago and Omaha with poor to fair strength. The Neutrodyne brought in on the loud speaker Chicago, Omaha, Schenectady, Ames Iowa, Philadelphia, Cleveland,

St. Louis and others that we did not wait for. The remarkable things were signal strength and selectivity. Minneapolis came in without aerial or ground too loud for comfort. Omaha and St. Louis were good without either aerial or ground connections.

"No interference between stations was noticed at all. The quality of the signals from the three strongest stations, Minneapolis, Omaha and St. Louis, was perfect, despite the fact that the tubes were being worked to their utmost capacity, speech being intelligible fully a block away.

"Comparison of notes with other experimenters this morning shows that last night was poor radio weather, and regenerative sets failed to bring in any stations but Omaha and Chicago. Needless to say we did not use the phones at all with the Neutrodyne."

Hundreds of similar enthusiastic letters are being received from men who have built Neutrodyne Receiving Sets.

## YOU CAN ASSEMBLE THIS SET YOURSELF

This handsomely printed book "How to Build Hazeltine's Neutrodyne Circuit Radio Receiver" that sells for 50c, tells simply and clearly exactly how to assemble this set. Nothing is left in doubt. The directions are written in simple, easily understood language. An actual size pattern is included that can be laid over the front panel and used as a guide for drilling the holes for the rheostats, phone jacks, pull switch binding posts and neutroformers, etc. Photographs show every step in assembling, adjusting and operating the receiver.

## SEND FOR YOUR COPY TO-DAY

Take the first step towards owning the most up-to-date and efficient radio set ever made by mailing the coupon to-day. This book not only tells how to assemble Hazeltine's Neutrodyne Set but it also shows specifically the FADA parts required and costs.

Be the first one in your town to construct a Hazeltine Neutrodyne Set using FADA parts—send the coupon today for this wonderful book.

Send  
right  
now!  
for the



"How to Build it"—Book

F. A. D. Andrea, Inc.,  
1581-K Jerome Ave.,  
New York, New York.

Enclosed is 50c for a copy of "How to Build Hazeltine's Neutrodyne Receiving Set." If this book is not exactly as represented money will be refunded.

**F.A.D. ANDREA, INC.**  
MANUFACTURERS OF RADIO EQUIPMENT  
1581-K Jerome Ave.  NEW YORK CITY

Name.....  
Address.....  
City..... State.....





MARTINELLI—Victor Artist

The forty-three records by Martinelli listed in the Victor Record catalog are the authentic interpretations of this great tenor. They are Martinelli himself—every record carries with it his own personal approval. His selections include:

Eugene Onégin—Air di Lenski	}	Double-faced
L'Ultima Canzone		6195 \$2.00
Ernani—Come rugiada al cespite	}	737 1.50
Iris—Apri la tua finestra		
William Tell—O muto asil del pianto	}	6212 2.00
Traviata—Dei miei bollenti spiriti		



BORI — Victor Artist

There's a charm to Bori's every interpretation that is most delightful, and it is depicted with absolute fidelity on Victor Records. This life-like quality is readily apparent to the artist herself—to every one upon hearing any of her twenty-five records. Among them are:

Traviata—Addio del passato	}	Double-faced
Don Giovanni—Vedrai, carino		543 \$1.50
Malagueña	}	544 1.50
Clavelitos		



DE LUCA — Victor Artist

Whatever De Luca sings is rendered in a manner that is perfection itself, and he finds every selfsame quality reflected in his Victor Records. Thirty-one numbers have been recorded to date. Here are some of them:

Barbiere di Siviglia—Largo al Factotum	}	Double-faced
Ernani—O de' verd' anni miei		6077 \$2.00
William Tell—Resta immobile	}	596 1.50
Marriage of Figaro—Se vuol ballare?		
Don Carlos—Per me giunto è il dis upremo	}	6078 2.00
Masked Ball—Eri tu		



Victrola No. 230  
Spring motor, \$375  
Electric, \$415  
Mahogany  
Other Styles \$25 to \$150

The Victor Company originated the modern talking machine and was the first to offer the public high class music by great artists. Victor Supremacy began then. It has been maintained by the continuing patronage of the world's greatest musicians and by the merit of Victor Products.

In buying a talking machine consider that you must choose the Victrola or something you hope will do as well and remember that the Victrola—the standard by which all are judged—costs no more.

To be sure of Victor Products see the following trade-marks under the lid of every instrument and on the label of every record.



# Victrola

Look under the lid and on the labels for these Victor trade-marks  
**Victor Talking Machine Company, Camden, N. J.**